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Ferdinand Rudolph Hassler (1770-1843)

A Twenty Year Retrospective, 1987-2007

Compiled and Edited by

Harriet Hassler
Information Services Division
National Institute of Standards and Technology

Captain Charles A. Burroughs
NOAA Corps (Retired)
National Oceanic and Atmospheric Administration

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March 2007

U.S. Department of Commerce
Carlos M. Gutierrez, Secretary

Technology Administration
Robert Cresanti, Under Secretary of Commerce for Technology

National Institute of Standards and Technology
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Abstract

This publication compiles remarks, papers, and photographs associated with several events held over the past twenty years honoring Ferdinand Rudolph Hassler, first Superintendent of the Survey of the Coast and first Superintendent of Weights and Measures. These related events begin with the 180th anniversary of the establishment of the "Survey of the Coast," celebrated in 1987, and continue with the renovation the Hassler memorial monument on the outskirts of Philadelphia. Out of that monument renovation, completed in 1993, came two additional memorials, one at NOAA headquarters in Silver Spring, Maryland, in 1995, and another at NIST in Gaithersburg, Maryland, in 2004. This publication also presents materials previously unknown to earlier Hassler historians such as the recently uncovered Hassler correspondence to Admiral Adam J. von Krusenstern obtained from the Russian State Archive of the Navy in St. Petersburg. A comprehensive Hassler bibliography is also included.

About the Editors

Harriet Hassler is a Technical Services Librarian at the NIST Research Library, Gaithersburg, Maryland. She has worked in federal libraries since 1997. She is a seventh-generation descendant of Ferdinand Rudolph Hassler. Ferdinand R. Hassler V, whose presentation is included in section 5.6, is her father. Ardoth A. Hassler, whose presentation is included in section 5.7, is her aunt.

Captain Charles A. Burroughs served in the commissioned corps of the U.S. Coast and Geodetic Survey, the United States Environmental Science Services Administration, and NOAA from 1958 to 1985, including nine years of sea duty. He is a former President of the Washington Map Society, and former editor of that Society's journal, *The Portolan*.

Frequently Used Abbreviations

NIST National Institute of Standards and Technology
NOAA National Oceanic and Atmospheric Administration

1. Introduction

Ferdinand Rudolph Hassler (1770-1843) is considered the forefather of both the National Oceanic and Atmospheric Administration (NOAA) and the National Institute of Standards and Technology (NIST). His achievements as both first Superintendent of the Survey of the Coast and as first Superintendent of Weights and Measures are documented in this publication.

The idea for this publication originated in 1993 shortly after the unveiling of the renovated memorial monument to Ferdinand Rudolph Hassler, located at the Laurel Hill Cemetery on the outskirts of Philadelphia. The publication was originally envisioned to be a "Memorial Booklet" to be issued in conjunction with a private fundraising effort that made that renovation possible. But with the creation of two subsequent national memorials to Hassler, one at NOAA headquarters in Silver Spring, Maryland, in 1995, and the other at NIST headquarters in Gaithersburg, Maryland, in 2004, it was deemed appropriate to document all of these events with a more substantial publication.

With this publication, the editors wished to make available a wealth of previously unpublished information about Hassler, as well as to reprint some previously issued material that was not widely available. A quick look at the Table of Contents gives one an appreciation for the broad scope of what is now incorporated. Over and above papers presented at the several events already noted, the chapter titled "Hassler's Legacy Recognized" commences with one of the many addresses presented at the Centennial Celebration of the U.S. Coast and Geodetic Survey in Washington, D.C., 1916. Dr. Samuel W. Stratton, Director of the Bureau of Standards, spoke eloquently of Hassler's many contributions to setting the standards for excellence in the early measurement sciences of this country.

After reproducing many of the papers presented in conjunction with those events of 1993, 1995, and 2004, yet another item of note came along in 2006 with the publication of Dr. Albert C. Parr's "A Tale About the First Weights and Measures Intercomparison in the United States in 1832." Included in this article were the interactions that took place between Hassler and Admiral Adam J. von Krusenstern of the Russian Navy, who both happened to be in London at the same time on similar missions during 1814 and 1815. Although not meeting again thereafter, they managed to engage in a lively correspondence for many years thereafter. As a result of this work by Dr. Parr, copies of several letters from Hassler were retrieved from the Russian State Archive of the Navy in St. Petersburg and the text of these are being made available in this country for the first time. Dr. Parr donated a rare report with a handwritten inscription by Hassler to the NIST Research Library in 2006. A comprehensive bibliography of Hassler-related material is also included.

It seems only fitting that this publication becomes available to the public during the bicentennial anniversary year of the Act of Congress that created the "Survey of the Coast" in 1807 under the administration of President Thomas Jefferson.

2. Hassler's Legacy Recognized: 1987, Before, and After

2.1 Overview

This section contains a collection of articles about F. R. Hassler from the years 1916 to 1995, centering on the year 1987 when NOAA celebrated its 180th Anniversary with a commemorative symposium honoring the creation of the Survey of the Coast and Hassler's contributions. Together, this collection of articles provides a thorough background about Hassler's accomplishments both as a geodesist and as a metrologist. The descriptions of Hassler's works contained in this section explain the continued interest in Hassler in recent years and why monuments to his achievements were later installed at both NOAA and NIST headquarters, as described in Sections Four and Five.

The first article dates from an earlier anniversary — the centennial anniversary of the U.S. Coast and Geodetic Survey (now called the National Ocean Service, a part of NOAA). This was celebrated in 1916, marking 100 years since the beginning of field work on the Coast Survey in 1816 by Hassler. The Centennial Celebration was an extraordinary affair held in Washington, D.C., which included a symposium held at the Smithsonian auditorium and a banquet at the Willard Hotel where speakers included the President of the United States, Woodrow Wilson. Dr. Samuel W. Stratton, Director of the Bureau of Standards, gave the speech, "The Bureau of Standards and its Relation to the United States Coast and Geodetic Survey" which is reprinted here. Prior to the creation of the Bureau of Standards in 1901, its progenitor, the Office of Standard Weights and Measures, had resided within the Department of Treasury as an office within the Coast Survey. Hassler was the first superintendent of both Weights and Measures and the Coast Survey and so as a man embodies the close tie of these two sibling organizations, joined together today within the Department of Commerce as NIST and NOAA. Dr. Stratton's remarks speak directly to this relationship, and are revealing about the character of F.R. Hassler.

The second article, "Hassler's Legacy," was published in 1976, in *NOAA Magazine*, as part of that agency's celebration of the U.S. Bicentennial. The author, Albert A. Stanley was a 47-year employee of the U.S. Coast & Geodetic Survey and well-versed in the history of that organization and its origins with Hassler.

The interest in Hassler carried through to 1987, when NOAA commemorated the 180th Anniversary of the Founding of the Survey of the Coast. Two pieces from this period, both by Captain Charles A. Burroughs, are presented here, including Burroughs' remarks delivered at the commemorative symposium held in February 1987. His article, "Hassler's First Chart" is also reprinted from *The Portolan*, journal of the Washington Map Society.

The final article in this section was published in 1995 a few months before the dedication of Hassler Park at NOAA covered in Section Four. Part one of a four-part series on the "History of Geodetic Surveying," this installment details the Hassler years up to his death in 1843. The author, Joseph F. Dracup, highlights Hassler's contribution from the viewpoint of a geodesist.

In summary, this section speaks to the many specifics of F.R. Hassler's service to the United States. These form the foundation of the Hassler legacy celebrated in later sections.

2.2 *The Bureau of Standards and its Relation to the United States Coast and Geodetic Survey,* by Samuel W. Stratton, Director, United States Bureau of Standards, 1916

Reprinted from: ***Centennial Celebration of the United States Coast and Geodetic Survey, April 5 and 6, 1916, Washington, D.C.*** **Washington, D.C.: U.S. Government Printing Office, 1916, 25-40.**

This document begins on the following page.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
E. LESTER JONES, SUPERINTENDENT

CENTENNIAL CELEBRATION

OF THE

UNITED STATES COAST AND GEODETIC SURVEY

APRIL 5 AND 6, 1916

WASHINGTON, D. C.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

THE BUREAU OF STANDARDS AND ITS RELATION TO THE UNITED STATES COAST AND GEODETIC SURVEY

Doctor STRATTON: Mr. Superintendent, ladies, and gentlemen, there is so much that the Bureau of Standards owes to the Coast and Geodetic Survey that I fear in the time to which I am limited I can do no more than pay tribute in an humble way to some of the more important points.

Superintendent Jones has referred to the work of the first superintendent of the Coast and Geodetic Survey, F. R. Hassler. Those of you who have had an opportunity to look over the early legislation regarding weights and measures will find that the subject was recognized in the Articles of Federation and in the Constitution. Washington, in his first address, pointed out the necessity of making provision for standard weights and measures; he repeated this in the second and in the third

addresses. Jefferson was ever mindful of this necessity and made reports upon it. John Quincy Adams made a report in 1821, which has become a classic in weights and measures literature.

Why was it that in all this time nothing had been done beyond the suggestions of legislatures and statesmen? There was something lacking—it was the man. Jefferson found the man, as shall be seen later. It is well known that Jefferson was very much interested in scientific matters and was acquainted with all of the scientific men of this country at that time.

When the man (Mr. Hassler) was found, he was at once sent to England to procure the necessary instruments for a coast survey. The first and most important instrument he secured was the standard of length, the basis of all the work to follow in the triangulation of the coast. He at the same time contracted for theodolites and other instruments to be used in conjunction with the standard of length.

Mr. Hassler was, indeed, a remarkable man. I consider that he was not only the first and foremost man in the scientific work of our country at that time but one of the leading, if not the leading, metrologists of his day. I doubt if there were more than half a dozen people in the world at that time who possessed the scientific knowledge and the deftness of the artisan necessary to undertake this work. He knew where to find the instruments; he knew where to find the artisans to construct the standards and apparatus that were necessary in the survey and in the weights and measures work. In addition, he had studied in the leading countries of Europe and had collected a wonderful library of books, a most unusual thing for one of that day. This will be referred to later.

As you of the Coast and Geodetic Survey know, when the set of instruments secured abroad by Mr. Hassler arrived, the coast survey work for the time being was abandoned. The instruments were stored. Mr. Hassler states that in the interval he assisted in fixing the northern boundary line of the United States, performed some duties at West Point, and sometimes refers to his farm up in New York, in which he, no doubt, took a great interest.

The real work in connection with weights and measures in this country began with the reorganization of the Coast Survey. Mr. Hassler was made its first superintendent. In this work he used the standards which he himself had brought to this country. It is remarkable that when he came to this country he brought with him one of the best standards of length of the day, upon which he later based the coast-survey work, not expecting, so far as I can learn, to have any connection with the scientific work of his adopted country.

At the reorganization of the Coast Survey, or very soon thereafter, the Senate by resolution directed the Secretary of the Treasury to examine the weights and measures of the customhouses. Up to this time the various customhouses had worked independently of each other; they

used separate weights and measures from wherever they could be obtained—most of them came from England—and in some cases the customhouses depended upon the ordinary standards of the local officials.

Mr. Hassler's report of this duty is one of the most interesting documents I have ever read. It is as fascinating as any romance. It is, indeed, too bad that we have to look to his defenses for the real and interesting facts of this great work. Then, as now, auditors and accounting agents were always looking for discrepancies in the accounts of Government employees. Scientific men, then, as now, were strictly honest, and they thought that everybody ought to know it, and they naturally resented any questioning of their accounts. The most interesting part of this report consists of the replies that Mr. Hassler made to these alert employees of the disbursing and auditing offices, and I am going to quote from one or two of them merely because they give us some very interesting history, history that refers closely to the origin of our weights and measures.

When he was given the duty of examining these standards he might have contented himself merely by gathering together the standards of the customhouses, comparing them, and then adopting something that was uniform, but being a man of scientific attainments and a metrologist in the strict sense of the word, he foresaw that the commerce of the country would depend upon this work, that the weights and measures of the country would follow those of the Government, and that eventually we must come to uniform standards.

Now let us examine the history, the documentary evidence of the standards that he got together and compared, and I must pause here to say that this comparison was such as would do credit to any of the members of the Bureau of Standards to-day. I now quote from his report, made about 1831 or 1832, to the President of the Senate upon the work that he was delegated to do. The State Department, through gifts from other nations, had a few standards, which he involved in this comparison.

Vouchers upon the origin and authenticity of the standards included in this comparison, other than those from the State Department.

1. Standards from the collection of instruments for the coast survey.

The accuracy of the unit of length measure to be employed in the coast survey, was such an indispensable requisite, that I took, of course, all necessary measures to obtain it, when I was in Europe to procure instruments for that work. The French mètre is the absolute unit of length which has been the most accurately determined. It is presented multiplied in the original by 15 bars of iron and one bar of platinum, cut to that length; and the temperature of melting ice, or 32° Fahrenheit, is the standard temperature for the same.

The English standard of length consisted, until the late changes made in England, in a brass scale of undefined length, divided into inches and tenths of inches, the mean of which, for any length, measured upon as many parts of the scale as found proper, was considered a standard of that length, at the standard temperature of 62° Fahrenheit. As it was naturally desirable that the distances of the survey would

be given in both lengths, I caused Mr. Troughton, in London, to construct the scale of 82 inches English, quoted in the preceding list, which he made by doubling his own scale, after having made a new table of errors, to correct this transfer by it, from the same he had already divided the scale of Sir George Shuckburg Evelin, which has served for his comparison in 1795, and since for those lately made by Captain Kater. This scale, the accuracy of which within itself is exhibited by the statement to be seen in the detailed account of the operation of the present comparison, forms, therefore, a direct link to unite the present comparison with the late English determinations of the yard and pendulum, as well as the general means of comparison.

Mr. Lenoir, the mechanician, of Paris, who constructed the mètres for the Committee of Weights and Measures, having, at the same time with those above quoted, standarded a brass mètre for himself, at the temperature of 32° Fahrenheit, I procured a copy of the same, which was compared at the Observatory of Paris with the mètre there preserved. The certificate signed by Messrs. Bouvard and Arago states it to be too short for 1-100 part of a millimetre, or 0.00039381o of an English inch, and is dated 16th of March, 1813.

The iron toise was also made by Lenoir, and compared at the Observatory at Paris by Messrs. Bouvard and Arago, under the above date.

Having by the above so much of the standards, I found it proper, and hoped in future useful, to make the small additional expense of procuring also accurate weights. The balance of Troughton, with grain weights, which were again exactly verified by him. Of Fortin, the mechanician in Paris who had construeted the weights, and litres modèles for the Committee of Weights and Measures, I procured two subdivided cubical kilograms, with the decimals to the milligramme, and two litres modèles; by procuring two individuals of each kind, I obtained the indication of the degree of accuracy with which they are made, and their coincidence has been very satisfactory.

Right there is an indication that he was an experienced metrologist. He got two of the articles in order to find their variation.

2. The Philosophical Society in Philadelphia is in possession of several, and, in their kind, the most valuable standards; which I brought with me to this country on my arrival in 1805. I was favored with a loan of them for the present comparison.

The iron mètre is one of the original standards made by the Committee of Weights and Measures, as quoted above.

That part of the work being under the special direction of Professor Tralles, my friend and teacher in mathematics, member of the committee, as deputy from the Helvetic Republic, he made three of the above iron mètres more than what was required for the deputies present; one of these he made a present to me, which is the one here compared. It is, therefore, fully accurate, and of original authenticity.

The same is the case with the kilogram of the society. Its origin and history is in every thing exactly the same, except that it was Mr. Van Swinden, deputy from the Batavian Republic, who had the special care of their construction. The one present is No. 2, as a label in the box indicates. A private paper of Mr. Tralles, in my possession, not yet printed, detailing the ultimate comparisons of the mètres, the kilogram, and also those of the toises, designated this kilogram No. 2 as entirely exact.

The toise of Canivet, of 1768, I purchased in Paris, in 1796, from the heirs of the late Mr. Dionis Dusejour. It is in perfect preservation, being guarded by a matrix, so as never to expose its determining ends; it has marked on the reverse the double length of the pendulum under the equator, which indicates its having been designed for the comparison; when, at the epoch of its construction, this length was proposed as an unit standard from nature.

The society possesses, also, two copies of the well known toises of Lalande, made by myself, on the occasion of my triangulation of Switzerland in 1791. They were

included in my comparison for the coast survey, but I did not find proper to make them enter into the present.

3. The Treasury Department acquired of me lately the standards which I had yet in my possession for my private use. The scale of 52 inches has also marked upon it the distance 51.2 from Sir George Shuckburg's scale. On account of that, I immediately purchased it from Mr. Troughton, when I saw it in his workshop, as it furnished a direct comparison with that scale; which has become of great importance by its use in the English comparisons.

Before I delivered the instruments for the coast survey, when that work was interrupted, I laid off upon it, 1st, from the middle of the large scale of Troughton the divisions in tenths of inches; 2d, the mètre from the brass mètre of Lenoir, in the coast survey collection; 3rd, the half toise from the half of the toise of Canivet.

The yard between platinum dots, I procured from Mr. Troughton, upon yet imperfect information upon the new yard established by the last English determinations, which proved what since became public; and the result of the present comparison shows: that it is actually only the old exchequer yard that was adopted: it is less than the exchequer copy of the State Department, of Jones, only by 0.00005275 of an inch.

The Amsterdam foot was marked upon it, on account of its frequent occurrence in the measurement of land and lots in New York upon old titles; and for this also its comparison result, given in this report, may be useful.

The brass mètre of Fortin I had acquired in this country from an European scientific gentleman, finding it in full good preservation. Fortin certifies it to be fully correct, under date 24th December, 1824.

Knowing the occasions I would have to compare standards, I had an iron bar constructed for myself, at the same time as those intended for the base measuring apparatus, which are all equal in breadth and thickness to the original iron mètres of the committee. This I intended to convert into a mètre for myself; when near, still above the proper length, it was taken up in the comparisons made for the coast survey, where an additional mètre was needed. Only on the occasion of the present comparison, I had the opportunity to adjust it fully, it being besides necessary for the comparison of the iron mètres by combination.

The troy pound I had brought with me to this country in 1805. It was made in Switzerland by a careful artist of Arau, Mr. Esser, after one that I had received from Mr. Troughton. Mr. Patterson, Director of the Mint in Philadelphia, compared it in 1805, with the troy pound of the Mint then in use, and found them exactly equal; but the Mint pound having since been in frequent use, while I preserved mine always carefully, on a comparison made, in the fall of 1830, the former was found considerably lighter.

4. The *troy pound of the United States' Mint at Philadelphia*, was made by Captain Kater, purposely for the Mint, upon the request of Mr. Gallatin, who considered this an authority far superior to the comparison of the Exchequer. The weight is in form similar to those made by Kater for the Exchequer, and enclosed within its box, in a brass form, upon which is engraved, Pound Troy, 1824, Bate, London. A detailed certificate of Captain Kater, dated London, 30th June, 1827, certifies to the comparison, and quotes the ultimate experiments with the same. A certificate of Mr. Gallatin, of the 24th July, 1827, testifies to its origin, and President Adams, under date of 13th October, 1827, to the safe and undisturbed reception thereof, so as to warrant full trust in its accuracy.

The *mark* weights of *Madrid* and of *Mexico* were also received by authority; the former, called marco-castilliano, is one of the two made at Madrid upon orders of Mr. Everett, ambassador of the United States, and found exactly equal to that at the Madrid Mint, as certified by him under date of 30th January, 1827. It arrived entirely safe and well preserved at the Mint of Philadelphia, as testified by the officers of the Mint, 9th August, 1828.

The *Mexican mark* was procured from the Mint in Mexico, with the standard of which it was found exactly equal, by Mr. Poinsett, United States' ambassador there, as testified by him under date of 30th February, 1828. It was received in perfect order at the Mint, as testified by the officers thereof, 9th August, 1828.

5. When the present comparison was already in a considerable state of forwardness, information was received, that there was still extant, in the custom-house of New Hampshire, a set of standards of weights and capacity measures, from the old provincial Government of that State. Upon the request of the Treasury Department, they were forwarded here by the collector, and proved a valuable acquisition to the object of this comparison.

They bear generally the stamp of G. I., besides that of the Exchequer; are, generally speaking, in good preservation; but unfortunately, since the report inserted of them in the Report upon Weights and Measures of the honorable late President, John Q. Adams, they were sent to Boston for verification, where several capacity measures were reduced, by means of lead fixed in their bottoms. This was evidently intended to bring them down to the newer standards, which appear generally to have suffered a reduction by negligence. The weights appeared not to have been altered, except the 14 and 56 lb., which had a little lead added to the bottom.

6. The two brass mètres of the Engineer Department have no special authority or certificate, except the name of the maker, Lenoir, engraved upon them.

7. The city of New York having procured a set of copies of the Exchequer standards, they were lent to the State Government to make standards for the State from them.

And so on. A number of others were secured in the same way, showing that he realized that the first step necessary was to procure the most accurate scientific standards in existence.

We will now pass on to another of these replies to the auditor's criticisms. Looking through this most remarkable report we find him charged, by implication at least, of selling his books to the Military Academy at West Point, and again selling them to the Coast Survey. And this is his reply:

The manner in which this article of the sale of F. R. H.'s books is treated is such as he must *repel* as a highly improper attack upon his character, in consequence of which it must become one of the articles of *special investigation*, because it is thereby intimated as if he had made a double sale of the same books to the government. Notwithstanding he does not consider himself bound to *give account to any man* upon the manner in which he disposes of his property, he has also no secrets, and therefore will place here the whole history of his library, of which much is contained already in former communications. F. R. H. had (as is still easily proveable), from the age of 16, in Europe, begun the selection of a scientific library, which, shortly before he left his native country, amounted to nearly 5,000 volumes; all the most valuable classical books in their branches, in diplomacy, history, law, mathematics, natural philosophy, and ancient classics; not a single common poet, novel, or such like ephemeral book, being in it. Intending to leave the country where the diplomatic and law part of his library applied to his occupations in public life, he sold that part of it, and came to this country in 1805, with about 3,000 volumes of books of all the most select ancient and modern classical, in natural and mathematical sciences, a great number of them very scarce, and no more to be obtained, but accidentally, as he had the occasion for during the time of his studies in Paris, Göttingen, etc., and paying often $15 and more for a volume; all of which can be proved by living witnesses in this country. Of the diplomatic part remaining some were sold to the library of congress.

Besides that, he brought a number of instruments, standard weights and measures, which are now yet the only equally accurate and authentic ones in this country, whence they are employed by him as principal means for the comparisons of weights

and measures, that have been presented by him in the report to congress upon that subject. (See the report itself, which was so highly approved in Europe and in this country.)

This attracted to him the men of science in Philadelphia, who shortly after selected him a member of the Philosophical Society there without his knowledge; these declared that such a valuable library and collection of instruments had never before come to this country (and it can be added, never since); they gave to the then President, Jefferson, information upon him, with a notice upon his former life, as proved by his documents, among which were the notices of the triangulation he had begun in Switzerland in 1791, and been interrupted by the Revolution.

This circumstance gave life to the idea that had been entertained then already for some years, particularly by President Jefferson and other eminent men of that time, to get, by means of F. R. H.'s experience, the so much needed work of the Coast Survey executed; wherefore he was spoken to, before the law itself was proposed that passed in 1807.

When in 1811 F. R. H. was sent to Europe for the procuring of instruments and books for the government, he also augmented his private collection; but finding it proper on his part to use the public funds intrusted to him only for the greater objects of immediate want for the Coast Survey works, he bought on government's account only the closest needed books of those times, as he also referred many smaller instruments to be procured later, when needed.

In selling what he called the remainder of his library, to the Military Academy at West Point, (the history of which transaction is even not very edifying,) it could not be expected that a man accustomed to books for his companions from childhood, would divest himself of the last book he had. It is besides evident that he, in such a case, will reserve by preference just such books that are the closest connected with his favorite occupation. In the present case, therefore, naturally just, the most valuable and most practical works for geodetical, astronomical, and similar purposes, were reserved.

Had not the Coast Survey been again intrusted to F. R. H., and had he not thought he could this time trust upon the stability of the government in maintaining a measure, taken with proper reflection and consultation of past experience, he would never have thought of parting with these books for the benefit of the work. This is what is refused, and even tried to be turned into *suspicion against his character.*

So far, however, as the accounts are concerned, (the other part belongs to the called-for investigation,) this difficulty is fully settled. F. R. H. has returned the money, and will take back the books again. He will never more offer or sell them to the government, nor direct the purchase of a single book for government's account, as it is decided by the Fourth Auditor that the assistants of the Coast Survey shall not be provided with means of instruction in their functions.

If any man of science had read and compared the two catalogues which both are among the documents of the Coast Survey, that of the books received from West Point, and that of those transferred by F. R. H., he would immediately have seen the distinctly different character of the two collections, and that many of the books of F. R. Hassler's transfer were not even in existence at the time of the sale to West Point, many being presents from the scientific men and societies in Europe, and even from the Admiralty of England.

And I again ask your indulgence just for a moment. You all know how, periodically, the question of carriages and automobiles comes up in the Government service in connection with the auditing of accounts. I will read another of these documents, because of the interesting information it contains regarding the history of Mr. Hassler. This one is in

reply to charge No. 9 by the Auditor's Office of the Treasury Department concerning the purchase of a carriage. Superintendent Hassler goes on to state:

The purchase of the carriage, or rather Jersey wagon, with springs, is for the first onset grounded upon a special letter to that effect, addressed to the Treasury Department the 23rd November, 1816. In 1832 this was fully sanctioned by the reference of the Treasury Department to the former arrangements that are confirmed by it, and to propositions given in at that time by F. R. H. sanctioned by the reference to them. The whole history of the carriage (which Colonel Abert can attest) is the following:

It was at first intended to carry the instruments by hand from station to station, like F. R. H. was used to have it done in the rugged mountains of Switzerland. This, however, was found by far too cumbersome and *expensive* (as already stated). The habitual construction of carriages was found, as well in form as in softness of motion, entirely inadmissable, as much so as common wagons. To transport safely several delicate instruments of about one hundred and more pounds each, with a number of smaller ones, etc. which would have been useless if not transported carefully over bad mountain roads, was the question to be solved. Therefore, in consultation with the then accounting officer, (Colonel Abert, who can testify to every point,) it was decided to propose a peculiar conveyance, to be constructed for that purpose, which was immediately agreed to by the Treasury Department, by answer to F. R. H. that he must be the best judge upon the means of conveyance: that this included also the horses is an evident consequence—(see the letter quoted). Then F. R. H., with the assistance of a man in his own wages, placed in a corner of his room in Newark all the larger instruments, with their boxes, that were to be used at every station generally, and directed the coach-maker (Campfield, of Newark, yet living) to take the measure for the box that would hold them, just snugly pressed against each other, so as to prevent all jarring and shaking; and to mount this in the form of a kind of barouche, or what it may be found proper to call it, with a top folding down, for the shelter against rain when up, and to pass under the branches of trees when down, which was an absolute requisite,—for which, as also for greater security, the wheels were made lower than habitual, and upon the wide rut; and hang it upon good C springs and thorough braces, etc.; the instrument boxes having to stand even, while to obtain the proper effect of the springs and thorough braces requires a rounded bottom, the space between formed a double bottom, in which the smaller instruments, tools, journals, etc. always were transported; for the telescope, a large sword-case (as generally called) was added to the back of the carriage-box. This all forms the odd appearance by which this conveyance is known, as well as by the complete absence of all luxury. This proves all: that the second article of the older contract, quoted by the Fourth Auditor's letter, has nothing to do with the horses and the carriage, which were specially authorized, once for all, and confirmed by the agreement of 1832, which positively says—that the arrangement of the first agreement shall be continued, and refers particularly to F. R. H.'s previous propositions, in which these objects, with many others, were mentioned as necessary; therefore also the resulting expenditures passed in the accounts rendered to the First Auditor, who had all the necessary papers to assist a proper judgment, which the Fourth Auditor must obtain, if he has them not.

The above carriage having been sold at auction in 1819, after the Coast Survey was broken up for the first time, and while F. R. H. was engaged at the boundary line with Canada, he purchased it, together with the two horses that were sold at the same time, because it was needed for the use in that work; but his leaving that employment left him the whole upon hand as a useless loss, and he used it only to move to his farm in Jefferson county, New York, where it remained well sheltered until the Coast Survey came again into his hands in 1832, when it was immediately brought to his former

maker in Newark, N. J. New wheels and axletrees were made to it, and it was otherwise put in full repair, at the expense of F. R. H., so as to be really better than a new one would have been, obtained at that time. Then it was again transferred to the Coast Survey service, its original destination, where it might long yet render service in its destined capacity. The price set upon it, which the coach-maker who mended it said was cheap, was $500. It stood F. R. H. in the amount of $1,000, by the unfortunate circumstance of the failing of the aim of its employment in the northern boundary line.

The economy which this transfer and the purchase of the horses for the Coast Survey effect was very great, as the work could immediately proceed, while the construction of a new carriage of the same kind, which would have been *unavoidable*, which would have cost far more, and have delayed the whole remainder of the campaign of 1832, and the hire in the meantime would have cost more than all these purchases.

And there are still more of these intensely interesting documents.

When I first came to Washington in 1898 and visited the Coast and Geodetic Survey I was impressed with the character of the weights and measures instruments. Congress, after Mr. Hassler's report, directed the Coast Survey to furnish all of the States with copies of the standards which the Secretary of the Treasury had constructed for the customhouses. He constructed these copies for the customhouses without congressional direction, but was directed to furnish them to the States. This was really the beginning of the Office of Weights and Measures as a separate institution, but, of course, the Office of Weights and Measures was, as before, under the direct supervision of the Superintendent of the Coast Survey. It served the Survey as well as the Customs Service and to a very limited extent the public.

The entire work of constructing these standards, and the balances by which they were used, both for the States and for the customhouses, is one of the most remarkable pieces of work of that kind ever done, and it was accomplished under the most trying circumstances.

I have been told by an officer of the New Jersey Zinc Company that the hole still exists where the zinc was mined for the brass; that the copper was brought from Switzerland, and that the workmen were imported from abroad. But this I do know, that the work, done by hand in many cases and with the crudest sort of tools, was equal in many respects to that of the best workmen of to-day.

The work of the weights and measures division was forwarded by the Superintendents of the Coast Survey, notably by Bache, Hilgard, Mendenhall, and others, and in this Office of Weights and Measures there was a direct line of succession, as it were, one or more persons at all times being directly engaged in this work of metrology, and following the principles laid down by Superintendent Hassler. The Bureau of Standards inherited not only the Office of Weights and Measures, but inherited its personnel, and with it the chief of our weights and measures division at the Bureau of Standards, Mr. Fischer, and he, in a metrological sense, is a direct descendant of Mr. Hassler. It has remained

for the Bureau of Standards to make useful those standards which were sent to the different States.

When the Bureau of Standards was established, we were surprised to find that the States were doing little with these standards; things were at a standstill. And why? For the same reason they were at a standstill in the National Government until Mr. Hassler took charge. There was no provision by the States for their use. They were considered as souvenirs and stored away. It was necessary to have the personnel and the mechanism for making these standards available to the public, and that is what our Office of Weights and Measures is doing to-day, directly and indirectly through State officials.

I want also to mention another fact, which I think ought to be known and placed to the credit of the Coast and Geodetic Survey. When I first came to Washington and met the Superintendent of the Survey, he asked me to join his force temporarily and make a report as to what could be done to place the weights and measures work upon the basis necessary in the present day of precision measurements of all kinds. I made two reports, one based upon the enlargement of that work to the extent possible in its present quarters, and dealing solely with weights and measures of the kind we have been speaking. The other suggested the establishment of an institution having weights and measures functions in the broadest sense, covering measurements in the various lines of physics, the properties of materials and physical constants, etc., data which are needed to-day as much as standard pounds and yards.

It was the Superintendent of the Coast and Geodetic Survey, Doctor Pritchett, who saw that the second plan was the preferable one. He recommended it to the Treasury Department, and the Secretary of the Treasury directed that a bill be drawn looking toward the establishment of such an institution. Here, again, was a thing remarkable for a Government bureau, the suggestion of the separation from it of a part of its work. I think those of you who are connected with Government work will realize just what that meant.

The history of the Bureau of Standards is well known to you. It was established in 1901, and its principal work is standards, standardization, and methods of measurement, the result of which is the introduction of scientific methods and precision where formerly inaccuracy or even the absence of measurements prevailed. To-day the relations between that Bureau and the Coast and Geodetic Survey are as intimate as ever the relations were between the old Office of Weights and Measures and the Coast Survey. The Bureau of Standards serves the Coast and Geodetic Survey, as well as many or practically all of the other bureaus of the Government service; they are all working harmoniously together in this respect.

In conclusion, I have three or four slides showing some of the early standards. It will take but just a moment to show them, but before projecting them upon the screen I wish to make the suggestion that at

this centennial celebration the Coast and Geodetic Survey and the Bureau of Standards unite in securing the establishment in this city of a suitable memorial to its first superintendent, F. R. Hassler.

These views will be very much enlarged, but it should be borne in mind that the lengths are in yards, feet, etc.

Figure 4 is the Troy pound, procured in 1827 from England by Albert Gallatin, then minister of the United States at London, and used as the standard for the coining of money until just a few years ago. The avoirdupois pound adopted by Mr. Hassler as the standard was derived from this Troy pound, the Troy pound having 5,760 grains and the avoirdupois pound 7,000 grains.

Figure 5 is a view of the United States prototype kilograms, showing the way they are kept at the Bureau. The one on the right is known as kilogram No. 20 and that on the left is known as kilogram No. 4. They were acquired in 1890 and are copies of the international standard kilogram in the custody of the International Bureau of Weights and Measures situated near Paris and under the control of an international committee, one of the members of which is the United States. There are now 26 countries maintaining at joint expense the International Bureau, established in 1875, for the custody and comparison of the fundamental international metric standards, to which all metric units, measurements, and national standards of the world are referred. The prototype kilogram superseded in the United States in 1893 the old Arago kilogram used since 1821, in which year it was procured for this country by Mr. Gallatin while minister to France.

Figure 6 represents one of the balances. It was just as necessary to have balances as to have weights. These balances were made and distributed to the different States.

Figure 7 represents the new platinum-iridium meter. It was brought to this country in 1890, and adopted as the standard for all measurements in 1893. All of our measurements are referred to this meter. One of the most important things that the Coast and Geodetic Survey ever did in connection with the subject of metrology was to suggest the fixing of the relation between the meter and the yard. This was done under Superintendent Mendenhall. It was promulgated by Executive order, so that to-day the meter, representing as it does the most refined standard, serves as the standard length for both systems of measurements.

Figure 8 is the committee meter, brought to this country by Superintendent Hassler in 1805 and presented by him to the American Philosophical Society of Philadelphia shortly after his arrival. When he was put in charge of the Coast Survey, he secured the bar from the Philosophical Society, and it remained in the possession of the Coast and Geodetic Survey until the establishment of the Bureau of Standards in 1901. The committee meter has since been superseded by the new platinum-iridium meter.

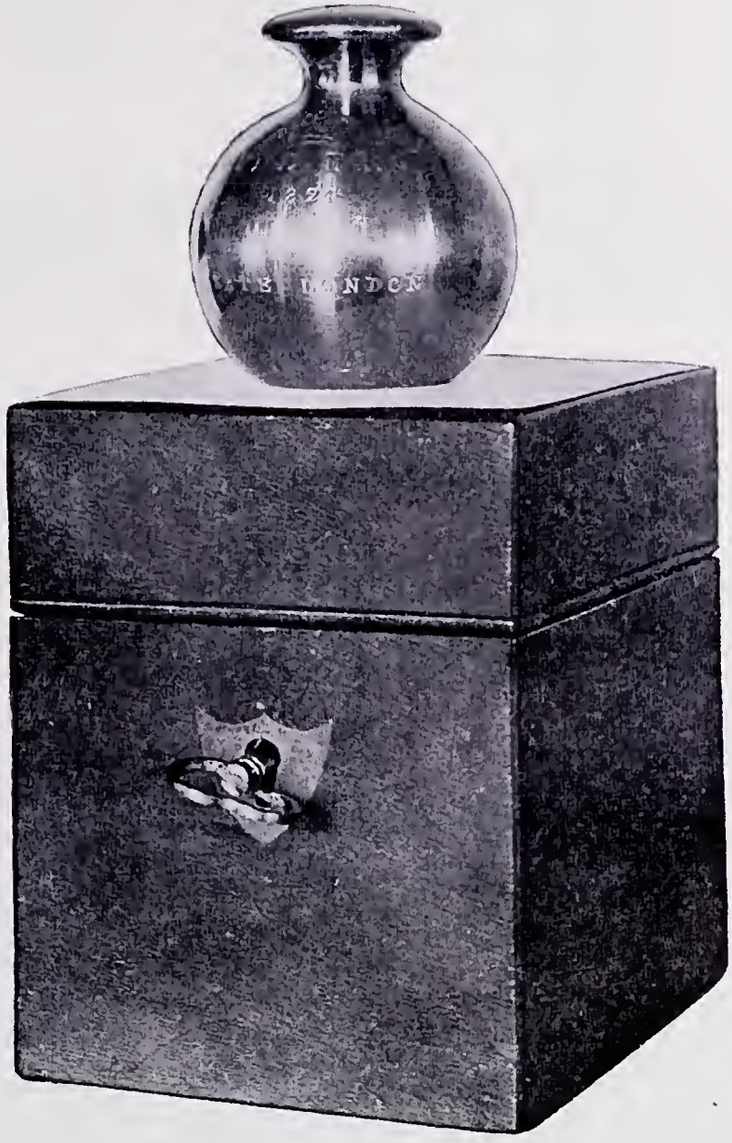


FIG. 4.—TROY POUND STANDARD

FIG. 5.—STANDARD KILOGRAM

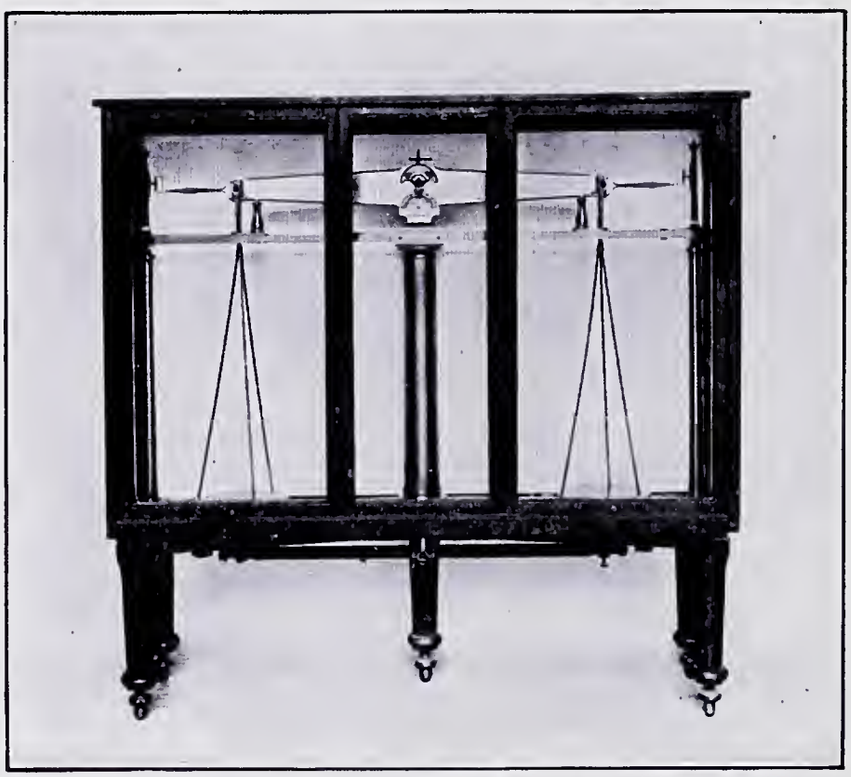


FIG. 6.—STANDARD BALANCE

FIG. 7.—PLATINUM-IRIDIUM METER

FIG. 8.—COMMITTEE METER

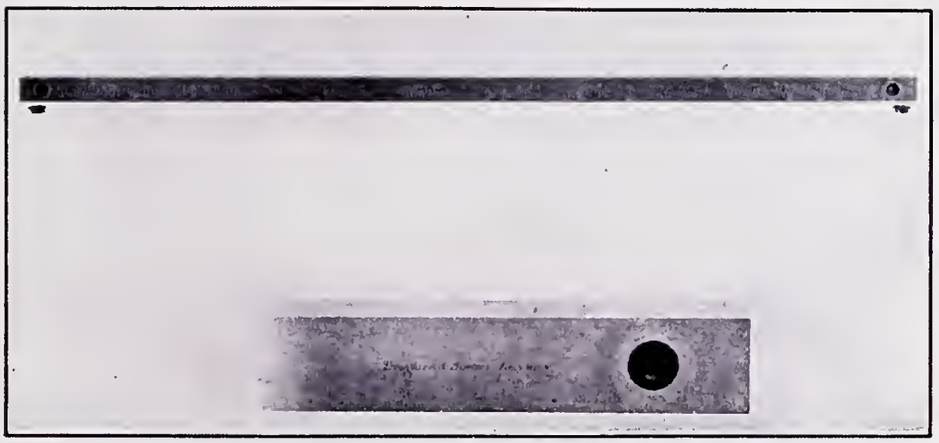


FIG. 9.—BRONZE YARD No. 11

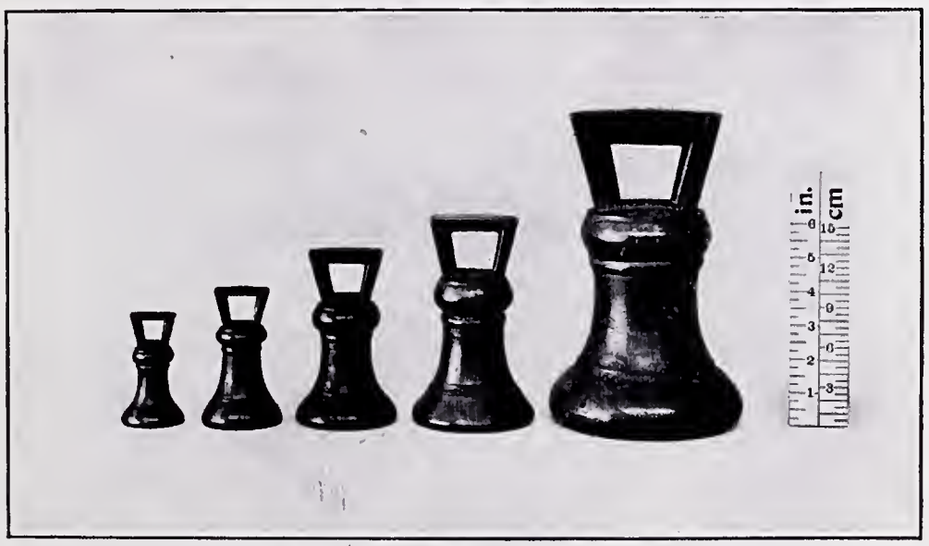


FIG. 10.—SET OF HISTORICAL STANDARDS

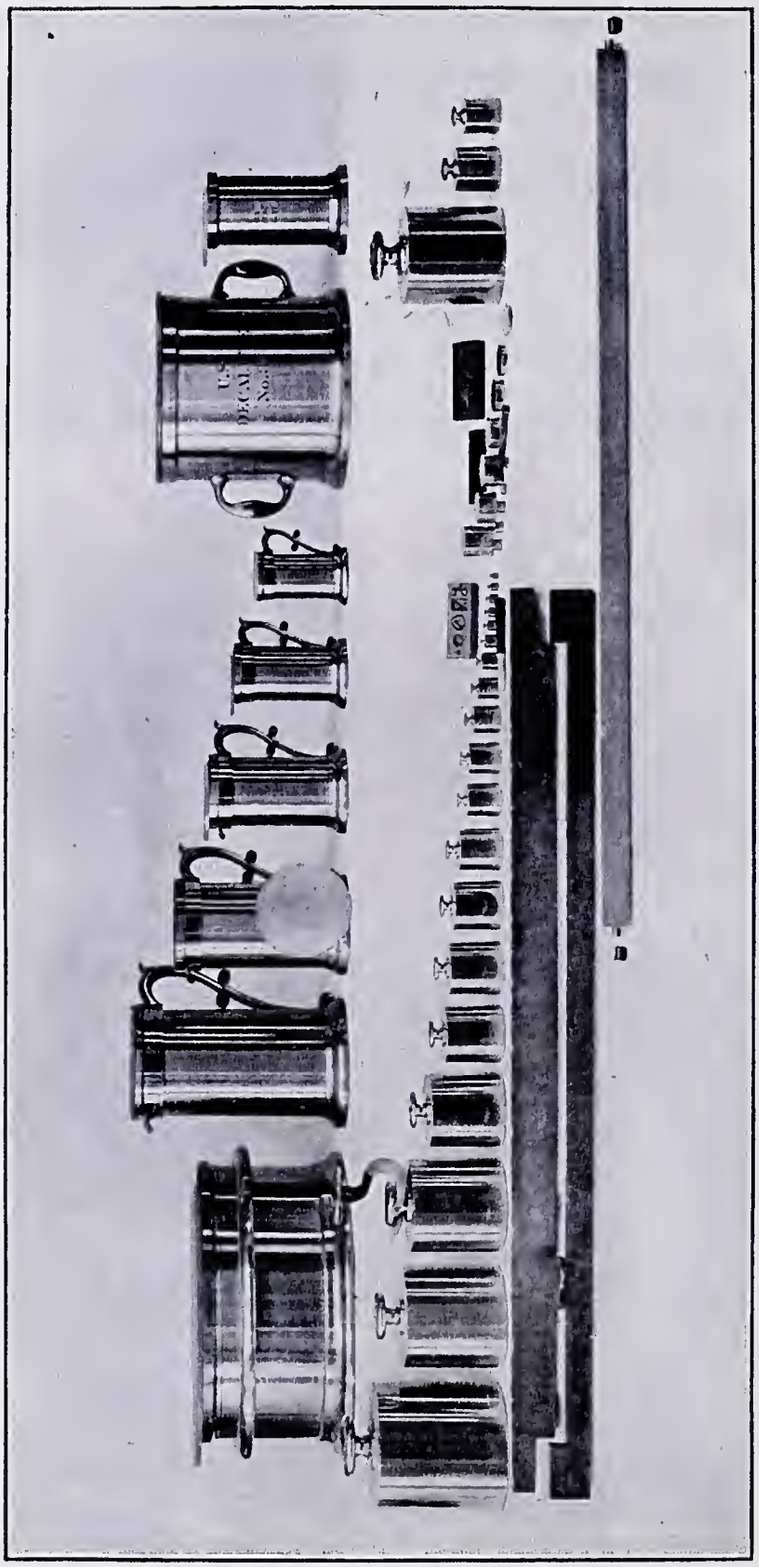


FIG. 11.—SET OF STATE STANDARDS

Figure 9 is the brass yard, known as bronze yard No. 11, sent to this Government by Great Britain in 1856. It was the standard of length in this country until the meter was adopted. You will observe in the enlarged view of the bar, which is now on its side, a circular recess; in the bottom of the recess is a small spot; that is a plug of gold on which is a fine line marking the end of the bar.

Figure 10 shows some of the old standards, probably from the State Department weights and measures.

Figure 11 is a set of the standards furnished to each State. There is the half-bushel on the left, the liquid measure on the right, etc. I have never seen better work by an instrument maker than this set of standards.

2.3 *Hassler's Legacy,* by Albert A. Stanley, NOAA, 1976

Reprinted from: *NOAA Magazine* 6, no. 1 (January 1976): 52-57.

This document begins on the following page.

One man's fortitude during the stormy early days of the National Ocean Survey left the United States

Hassler's Legacy

BY ALBERT A. STANLEY*

In the early years of the Republic, communication by land was meager, hazardous at times, and slow at best. Therefore the principal modes of transportation and communication between the colonies of Colonial America were by sea.

Moreover, young America at the turn of the 19th century was experiencing a tremendous growth in maritime commerce. Heavily laden cargo vessels and passenger ships with their precious burdens were entering and departing American ports for all parts of the world. The Louisiana Purchase created a special requirement for definitive coastal delineations. Since most communication between the colonies was by coastal shipping, it was paramount that critical coastal areas should be surveyed and adequate charts produced. This undertaking was essential to the new Nation's growth and progress.

Charts then in existence consisted chiefly of those produced by the British Admiralty of Colonial America for use prior to and during the American Revolution. These charts were based upon vague and incomplete reports and sketches, and were totally inadequate for needs of the times. Fragmentary measures were undertaken by the infant republic with localized and limited investigations of the coast, including a survey of the coast of Orleans in 1805 incidental to the Louisiana Purchase and a survey of the North Carolina coast in 1806. No effort had been made to coordinate the land or water surveys.

Commerce and industry concentrated along the Atlantic coast, with waterborne traffic the principal means of transportation, required immediate attention in the interest of economy, safety. and expediency. A decade or more before this time, a report had been made by a special committee of the Third Congress on February 27, 1795, which stated that the seacoast, not only of Georgia but also of South Carolina, North Carolina, and Virginia had never been surveyed with the requisite accuracy and concluded with the recommendation for the adoption of a resolution requesting and authorizing the President to cause a survey to be made of the coast between Chesapeake Bay and St. Mary's River. An additional report of like substance was made to the Fourth Congress.

These proposals generated debate and speculation until President Thomas Jefferson, in an address to the Ninth Congress in 1806, recommended the establishment of a "Survey of the Coast." On December 15, 1806, a U.S. Representative from Connecticut addressed the House upon the need of a survey of the whole extent of the coast of the United States. A bill was reported out of committee on January 6, 1807, and after amendment was passed and approved by President Jefferson on February 10, 1807, to provide for surveying the coast of the United States.

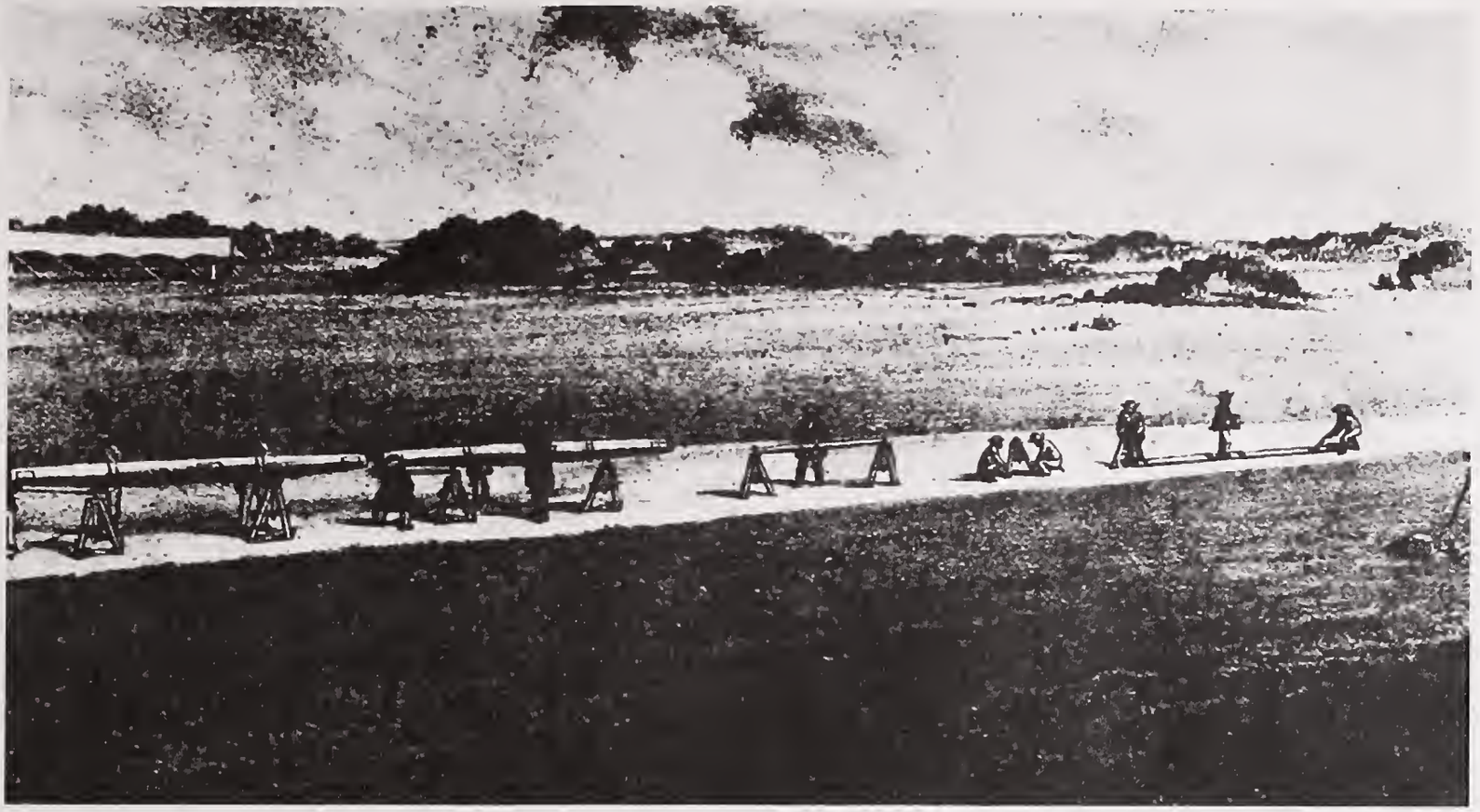
Execution of the Act of 1807 was assigned to the Treasury Department, under Secretary Albert Gallatin, who promptly issued a circular requesting men of science to submit plans for creating the first civilian scientific agency of the Federal Government. Of the thirteen plans submitted, seven were seriously considered but that by Ferdinand Rudolph Hassler, a leading international scientist born in Switzerland and residing in the United States since 1805, was accepted.

The Hassler plan reflected a thorough grasp of the problems involved in such a momentous undertaking. It drew from his experience in conducting field work on a trigonometric survey of his home district in Switzerland. The Hassler approach to the problem demonstrated a uniquely advanced knowledge of the entire field of geodesy in which he had gained international recognition. With the full support of the American Philosophical Society, he was appointed the first superintendent of the survey.

The Hassler plan prescribed the execution of a system of triangulation along the coast by which all detailed surveying operations would be controlled in accuracy, with each separate unit fitting exactly into the overall scheme. The plan presented two methods—the first by a complete triangulation survey of the whole coast, including the determination of the latitude, longitude, and azimuths of the principal places, such as lighthouses, capes, or prominent landmarks. The sides of the triangles were to be from about 60,000 to 100,000 feet in extent, resting on two or more bases—the baselines to be measured with all possible accuracy. The second method omitted the large triangulation, but retained the design of fixing the prominent points and features of the shore, by the same method of determining by astronomical observations their latitude and longitude, and correcting the differences in time, by the comparison of good chronometers. Details were to be filled in by appropriate instruments as circumstances might direct. The first plan was adopted as being more feasible and plans were made accordingly.

A principal element of the survey was to form a chain of triangles, with sides about thirty miles in length along the entire coastline, determining the azimuths of their sides and the latitude and longitude of their angular points. Within the large triangles were to be formed another series of triangles about ten miles along each side to provide an ample number of determined points to which the survey may be referred in all its detail. The entire net was to rest upon two or more baselines, measured with an accu-

Mr. Stanley is the National Ocean Survey's Special Assistant to the Director for Bicentennial Affairs.



racy to be obtained by methods and equipment to be designed as experience dictated. The baseline apparatus was perhaps the most original feature of the equipment assembled for the survey. It was based on an entirely new concept, Hassler's own.

After a lengthy trip to Europe, Hassler returned with an array of surveying equipment, build in accordance with his design, which was the envy of all surveying organizations of the leading nations.

Before any field work was started Hassler conceived the idea of a unique means of transporting his delicate instruments. He designed and had built by Camfield of Newark, N.J., a spring carriage of exact dimension and arrangement to accommodate his instruments. Hassler's famous yellow, horse-drawn travelling carriage was at first intended to carry instruments from station to station rather than by hand as had been the case in Switzerland. The specially designed conveyance was found to be the best means of transporting the instruments, some weighing 100 or more pounds each, over difficult mountain roads.

The coachmaker was directed to build a box that would hold the instruments snugly against each other so as to prevent jarring and damage from shaking. The carriage had a folding top for protection against rain. The wheels were extra wide and were made lower than a conventional Jersey wagon. The body was suspended upon strongly built, heavily braced C springs arranged so that the instrument boxes would stand even. In a locker under the seat, Hassler carried his extra clothing and a supply of Swiss

Making a base line measurement, using equipment designed by Ferdinand Rudolph Hassler, above. Below, Pro. Hassler's tent, with 30-inch Great Theodolite mounted inside (1838).

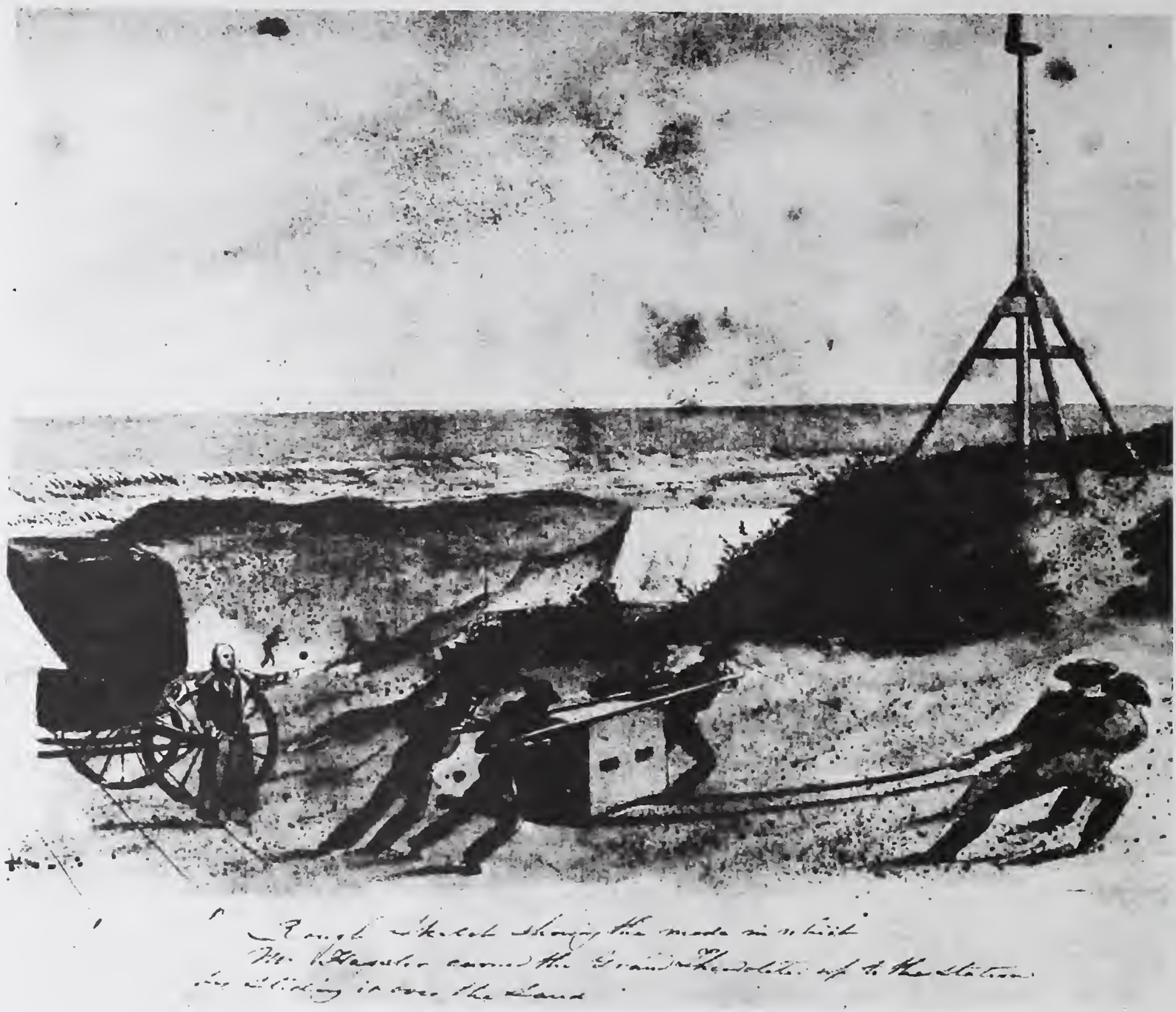
wine, crackers and cheese to sustain him in the field. With its suspended table, the vehicle served as Hassler's office by day and, with the table secured, as sleeping quarters by night. In the spring of 1817, field work with the new instruments was initiated near New York City.

After only five months in the field in 1817 agitation in Congress, reflecting a dissatisfaction with progress being made, brought a suspension of the work. This ushered in some fourteen years of the "Dark Ages" of the Coast Survey.

Hassler was not idle, however. He constantly emphasized the necessity of an accurate triangulation made with the best means that science and its auxiliary arts afforded. In reply to his critics, especially those who held that there existed in the United States a native talent abundantly sufficient for the management of institutions such as the Coast Survey without the use of foreign-born, Hassler affirmed that "the nation that excluded from itself the admission and use of foreign talents and knowledge, must always remain behind in the paths of civilization, and will appear comparatively barbarous, if not really so." He further stated as a precept that science, arts, and ideas for improvements are the common property of all nations which serve as their mutual ties; and cannot be succesfully cultivated without free intercourse, exchange, and intermixture.

In resuming work in 1832, the Superintendent, then 62, adhered to the principles he had prescribed. He adhered to unity by the shortest route by using the largest triangles that the localities of the country could accommodate. This often required the work to recede more or less from the outer limits of the seashore, due to a large part of the coastal zone being low, level, and bordered by forests and marshes with no prominent objects.

Hassler emphasized that the many and varied observations and other works, could not be performed by a single person, but



The Great Theodolite is laboriously dragged up to its station by the survey party by sliding it along the sand.

that trained assistants were essential. He prescribed that a full, clear, and minute scientific account must be published of the entire work from the initial observations up to the final results. The main objective of the Coast Survey, if it were to deserve the attention, respect, and confidence of the nation should employ a systematic trigonometric operation, with its accompanying astronomical part.

He prescribed many additional guidelines. Work was to be executed by the best means and methods obtainable from qualified engineers and devised by science. The Superintendent held that the more perfect the means to be used and the qualifications of assistants, the quality of instruments and all that can facilitate the observation and other works, the more fully will the objectives be met to become the base and standard of any future surveys that may be desired. The survey must present, not only the delineation of the shoreline, the soundings, and what may appertain to the safety of navigation, but also all that can in anyway be useful for the direction of the defense of the coast.

Hassler consistently declined to answer those who repeatedly demanded an estimated completion date for this work. The localities of the country which have never been investigated; the nature of the bottom in sounding areas; the more or less favorable seasons or circumstances; and the means in operators, instruments, and accessories that may be disposable are critical influencing factors not allowing one to estimate otherwise except for giving detail parts.

Encouragement was given the resumption of work in a letter to Professor Hassler by former President James Madison:—"I am glad to learn that you are to resume the important labor of Survey in the Coast. I hope you will be able to complete it, and to your satisfaction, in which case I doubt not it will be to the satisfaction of those who invite you to the undertaking." (February 22, 1832)

To contain all that is needed for the defense of the coast in case of attack, the

West Base camp, 1837 — one of the principal stations in the original primary triangulation executed by Hassler in 1837—1840.

Southwesterly view from Harrow, N.Y., 1838, with Hassler's carriage and Great Theodolite, approaching the hilltop station.

Survey of the Coast was projected landward to include waterways formed by the mountains bordering the valleys emptying their waters into the sea. Hassler also pointed out that the work should furnish the elements of any other survey that may be desired for a variety of public needs. Accuracy of the work, when properly executed, rendered it fit to become a standard to which other surveys may be attached. The work thus obtained the necessary degree of accuracy for any public undertaking of general utility to the country.

Hassler's own devotion to duty was unquestionable. In spite of his age, he was not content to direct his projects from a desk. In extending the major triangulation over Connecticut, Hassler met nature head-on while taking observations on Bald Hill near Wilton, Conn. on July 24, 1833. As a violent thunderstorm approached, Hassler removed the telescope from the theodolite and secured it with bedding. But before he could return to the theodolite, the storm with hail and torrential rain became so severe that members of the survey party had to use their combined efforts to hold in place the tent sheltering the instrument. With great difficulty, Hassler and an assistant lifted the theodolite in the open hailstorm after the tent had blown away. In putting it down, Hassler's coat, billowed by wind, caught on the instrument and upset it. The repeating circle escaped damage, but three barometers were broken and all tents but one were blown away. Three days before the storm, Hassler had fallen on a rock, receiving injuries so severe as to affect his speech. The severe drenching and exertions to follow, handicapped him for a long time afterward.

The most time-consuming operation in the initial effort was the measurement of the base lines. Hassler's base line apparatus was, perhaps, the most original feature of his plan for the survey.

During the latter part of 1834, Hassler measured the first major baseline with the highest degree of accuracy obtainable; much greater, in fact, than the two baselines measured in 1817. At every 400 meters and 1,000 meters, strong pegs were driven in

Easterly view from Stony Hill, New Jersey, 1838.

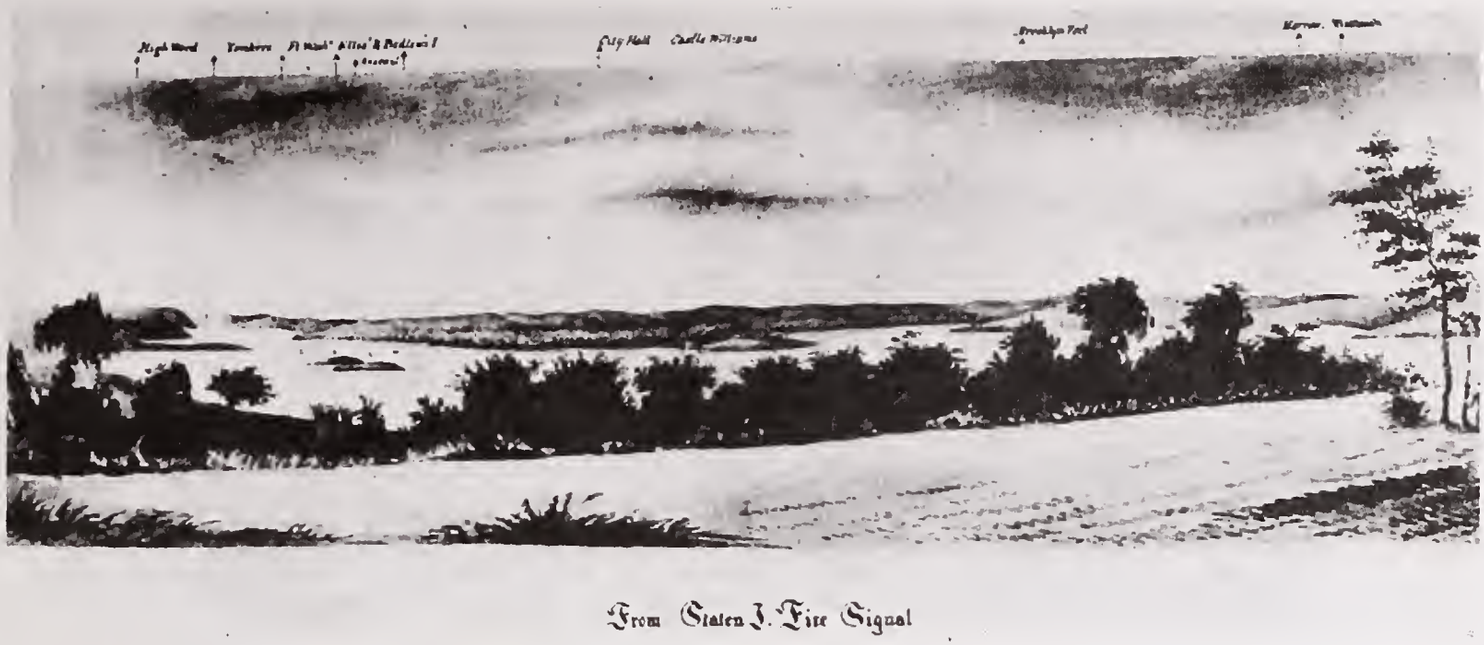
West Base station, above, showing the initial point of survey on Long Island, N.Y., and the survey camp of 1838.

the ground to mark their distance from the west end of the lines. At every 2,000 meters, stoneware cones were placed to make the points. Both ends of the base line rested on two sand knolls secured from the sea and marked by two monuments. The monuments consisted of a Newark red standstone, about 4 feet high, hewn square for about 18 inches from the top with a smooth top one foot square and a round hole in the center. Under the square cut, a frame was fixed in place, consisting of four pieces of hardwood, held closely by grooves chiseled in stone; the lower part was left rough. These stones were sunk entirely even with the sand, together with their frames which were extended about twenty inches on each side farther into the ground so as to make them solid, and maintain a perpendicular position. The distance between the monuments was about 8¾ miles. This operation required 45 days to complete.

It was painstaking and time-consuming work—some thought it too time-consuming. In the early 1840's Hassler again began facing critics of his work. Was he taking too much time? Was too much money being spent to compensate him and his assistants? Was it possible that even his methods were not the best and a chronometric system might be more useful?

Hassler's problems multiplied and he had various occasions to invoke his abiding motto: "Difficulties never subdued me in my life." In these dark hours, he never departed from his great purpose in life. At the height of the controversy, a committee, headed by Lt. Col. John J. Abert, of the Topographical Bureau, defended the work of Hassler and his associates. As an old West Point friend of the Superintendent, who had worked on the Survey in 1816-1818, he supplied an enlightened insight into the character of a genius much in advance of his place in history. Tribute was paid Hassler for his industry, his knowledge of business, and his enthusiastic devotion to the prosecution and success of the work, not to be equaled in his life.

A portion of Hassler's ambitious nature perhaps was passed down to his son, provid-



Northeast view from the Staten Island Fire Station, 1838.

East Base of the original permanent base line laid out on Staten Island to initiate the primary arc of triangulation in 1839.

ing a tragic sidelight to the annals of the Coast Survey. In addition to surveying the coast, Hassler was also occupied with the supervision of weights and measures. In this capacity, he laid the groundwork for the present National Bureau of Standards. His son, Edward Troughton Hassler, acted for his father as head of the Weights and Measures Office. This office provided pertinent standards to the various custom houses and state governments. Hassler died on November 20, 1843, and on December 12, 1843, President Tyler appointed Alexander Dallas Bache to the dual post. Bache immediately recruited his long-term friend, Joseph Saxton, who was also to become a Coast and Geodetic Survey pioneer personality, to serve as head of the Weights and Measures Office. Edward Hassler was offered the assignment of second in charge to Saxton; he had aspired to become his father's successor. He refused the offer and resigned. He went to New York to visit members of his family and there on June 14, 1844, ended his life in a New York hotel room.

A survey of the coast, now as then, remains a duty which requires the exercise of the highest functions of mathematical knowledge, and the utmost skill in geodetic science, astronomy, gravity, and related fields. Once executed, it must endure for many decades, must be well financed, and must be extended in keeping with advancing civilization.

Hassler's workshop, both field and office, was the only school in those early years in which selected individuals, with proper educational backgrounds could be found.

When Professor Hassler was buried at Laurel Hill, near Philadelphia, a scroll was placed on the casket, reading in part: "His scientific writings and the national works created by him for the United States serve not only as beautiful memorials of his active life but for the education and enlightenment of mankind."

His memory now lives mostly in the National Ocean Survey. The Nation, most of whose people never will know his name, owes him a debt of gratitude.

2.4 *F. R. Hassler: First Superintendent*, by Captain Charles A. Burroughs, NOAA (Ret.), 1987

Remarks made at the Symposium on the 180th Anniversary of the Founding of the Survey of the Coast, NOAA, Silver Spring, Maryland, February 26th, 1987.

In the construction of this tribute to Ferdinand Rudolph Hassler, first superintendent of the Coast Survey, I have drawn primarily from three or four sources; principally, Florian Cajori's *The Chequered Career of Ferdinand Rudolph Hassler*, 1929. Cajori was already an accomplished historian of the physical sciences when he was requested to compile this landmark treatise on Hassler, having published a *History of Physics* in 1899 and a *History of Mathematics* in 1894. Other valuable insights to Hassler are contained in the book marking the *Centennial Celebration of the United States Coast and Geodetic Survey, April 5 and 6, 1916*. Additional reference works are to be found at the end of this prepared text. Included is the *Superintendent's Report of 1844* following Hassler's death in 1843, from which I would like to quote Hassler's successor, Alexander Dallas Bache. It is very rare that one finds anything of a personal nature in any of these early reports, but in the following words we find a rare exception:

> "The coast survey owes its present form, and perhaps its existence, to the zeal and scientific ability of the late superintendent, F. R. Hassler, who devoted the energies of a life to it; and who, but for its interruption at a period when he was in the prime of manhood, and its suspension for nearly fifteen years, might have seen its completion. ... The difficult task of creating resources of practical science for carrying on such a work upon a suitable scale, required no common zeal and perseverance for its accomplishment, especially at a time [1807] when our country was far from having attained her present position in scientific acquirement, and when public opinion was hardly sufficiently enlightened to see the full advantages of thoroughness in executing the work. For his successful struggle against great difficulties, his adopted country will no doubt honor his memory, as the pioneer of a useful national undertaking..."

Hassler was born on October 7, 1770, in the town of Aarau in the northern part of Switzerland. His father, owner of a watch factory, was from a distinguished and wealthy family. At age 16, young Ferdinand became involved, largely through the influence of his father, with a Bureau in Bern charged with the business of "Landed Property of the Republic" that was, in turn, responsible for the archives under its care and all surveying. The chief of this Bureau, Johann Georg Tralles, a noted mathematician and astronomer, was to become Hassler's gifted and enthusiastic mentor. The young Swiss's work was of a voluntary nature, surveying during summers, office work during winters, together with studies in mathematics and geodesy at the public institution in Bern that was later to become known as the University of Bern. Tralles, himself, was later to become Switzerland's representative at a 1798 conference on weights and measures in Paris to establish the definite determination of the meter. Not only did Hassler pursue theoretical courses, but he teamed up with his instructor to undertake practical application of his studies as well. Together, in September of 1791, they performed baseline measurements of over 40,000 feet in length. This work eventually led to a complete triangulation survey of the Canton of Bern. By the age of 23, largely at his father's expense, he was also well on his way to amassing a vast collection of books on scientific and cultural matters, that, by the time of his departure for America, had included nearly five thousand volumes, many of which were quite rare and expensive.

The turmoil brought on by the French Revolution served as the catalyst to cause Hassler to direct his sights to the New World and become interested in the purchase of large tracts of land that were becoming available in the southeastern region of America. In the meantime, he had married Marianne Gaillard on February 1, 1798. On May 15, 1805, Hassler made his way down the Rhine and, by means of the chartered ship LIBERTY (350 tons), departed Amsterdam on August 4, arriving at the port of Philadelphia in September of that same year. He brought with him 120 Swiss emigrants and

their families, together with his wife, their four children, and 96 trunks, boxes, and bales, that included 3,000 volumes of classical works in history, mathematics, and natural philosophy from the previously mentioned extensive library. Also brought along were a number of instruments and standard weights and measures, including a standard meter, constructed in Paris in 1799 by the Committee of Weights and Measures, which subsequently became known as the "Committee Meter" of the U. S. Coast Survey.

As already noted, he did not come to America specifically to apply his scientific knowledge, but rather to follow agricultural interests and to establish a Swiss Land Colony in one of the southern states. However, the land deal fell through because one of the advance agents had speculated with the funds. Thus, Hassler immediately fell into financial straits and was forced to sell off a part of his library in order to provide for his family and to provide aid to many of the emigrants he had brought along with him on this venture.

It was during this early period that Hassler was able to come in contact with the leading scientific men of this country and was soon elected a member of the prestigious American Philosophical Society in Philadelphia. Throughout the 1790's, the presence of the nation's Capitol in this city had made it possible for this Society to fill a semi-public role. Thomas Jefferson, its vice-president from 1791, had become its president at about the time he took up his few duties as Vice-President of the United States in 1797. Thus, it is plain to see how Hassler was brought to the attention of the Chief Executive, soon after his arrival in this country. It might be further noted, as we prepare to celebrate the 200th Anniversary of the Constitution this year, that it was possible that the stated need to "Fix the Standard of Weights and Measures" in Article 1, Section 8, of this document may have caused Jefferson to cast an admiring eye on Hassler for his proven ability along these lines. But it was the "Commerce Clause," with which the Congress was more readily able to associate, that provided the constitutional framework upon which to formulate the "Survey of the Coast." As for the latter, it was becoming abundantly clear from the pressing demands by commercial interests that better charts and navigational aids were needed by mariners plying the nation's coastlines.

Time does not allow, for the purposes of this presentation, to go into all the ramifications of why Hassler's "Plan for the Survey of the Coast" came to be the accepted one out of the several put forth. Suffice it to say, his was the best formulated, most complete, and based on his solid surveying experience abroad, to be submitted in response to the law authorizing the Survey of the Coast, passed on February 10, 1807. His plan, in direct response to Albert Gallatin's Circular Letter of March 25, 1807, comprising six and a half pages written in French, was forwarded on April 3. It was later translated into English by his friend, Professor James Renwick of Columbia College. In the meantime, Hassler had been appointed professor of mathematics at the Military Academy at West Point on February 14, 1807. Hassler's plan was accepted by President Jefferson on July 21, 1807, and he was so informed through a letter from Robert Patterson, Director of the Mint, indicating "that for the time being the execution of the survey was suspended, because of the political disturbances in Europe and America." An initial appropriation of $50,000 had been made, however, for the purchase of instruments and other supplies needed for the Survey. This was twenty times that appropriated for the Lewis & Clark Expedition [$2,500] of only four years earlier and considered by the usual penurious Congress as an astronomical amount. The Act itself mentioned no department but placed the Survey directly under the President. The Treasury Department actually took up the work of organization because of its concern with lighthouses, because it was the most highly developed executive department, and because Secretary Gallatin was both Swiss and a man of scholarly tastes.

Hassler's professorship at West Point lasted until December 31, 1809. He resigned on February 14, 1810, as a result of a dictate by the new Secretary of War stating that "no law authorizes the employment of civilians at West Point." He next took a professorship at Union College from March 20, 1810, to July 23, 1811, as Professor of Natural Philosophy and Mathematics.

It was at this time that Secretary Gallatin was finally able to take up the work of the Coast Survey and sent Hassler on a mission to London for the procurement of the requisite instruments. A year later, he received instructions from Washington to remain in London until completion of the object of his

mission, "political changes notwithstanding." Of the many instruments and standards of measure procured, most were custom made, to Hassler's specifications. For instance, orders were placed with Edward Troughton, Instrument-maker, for a two-foot theodolite with new features designed by Hassler, two transit instruments for observatories, mountain barometers, thermometers, a very fine balance, and a Standard English brass scale. From William Hardy, he ordered two astronomical clocks and two time pieces showing the three-hundredth part of a second. By July 25, 1815, his mission was completed, with all instruments packed and ready for shipment. That collection of instruments, so procured by Hassler was, even in Great Britain, declared to be the best that ever left England.

On May 2, 1816, Hassler was notified that appropriations for commencement of the actual survey had passed. His salary, initially set at $2,500 per annum, was indicated by him to be insufficient, and through a very effective appeal process, was adjusted to $3,000 per annum plus $2,000 for expenses. Accounts related to his mission to London were settled and the proposed survey began near New York. On August 3, 1816, Hassler received his official notification of appointment as "Superintendent of the Survey of the Coast." He was finally successful in his solicitation of reconnoitering assistance with the assignment of three cadets from West Point and eventually obtained two valued assistants, Major J.J. Abert of the U.S. Topographical Engineers and General J.G. Swift.

At this point, he moved his family from Philadelphia to Newark. He also employed his 17-year-old son, Scipio, and commenced with base line work. By early spring of 1817, he had constructed for him a special carriage to transport his delicate survey instruments and ancillary equipment. During the year 1817, work on the survey proceeded steadily. He took observations on Weasel Mountain and later on Cranetown Mountain, Springfield Mountain and a few other stations. All the angular measurements actually used in the final computations of this first triangulation network of 1817 had been observed by Hassler himself. Also included were the measurement of two bases and a number of latitude, longitude, and azimuth observations that were made to give the network its proper orientation relative to the earth.

In spite of this industrious start, with minimal resources and given the vagaries of the northeast weather, Congress was so upset with the little progress shown by the spring of 1818, that the law authorizing the Survey of the Coast was repealed - - so modified that only military and naval officers could be employed in the Survey. In this we see the same ploy that had been used eight years earlier to oust Hassler from gainful employment at West Point. Interestingly, this was just about the same time that the War Department became increasingly engaged in launching into scientific and exploratory activities of their own with the Long expedition to the Rockies by way of the Missouri River in 1819. Soon thereafter, "civil" engineering was distinguished from "military" engineering through its emphasis on surveying for railroads and canals. Yet, through the Survey Act of 1824, it was the Corps of Topographic Engineers under the War Department who were called upon to make a comprehensive plan for needed canals and roads.

But what became of the beleaguered Hassler during this period? Almost immediately, he was called upon by President Monroe to take up the work of determining the boundary line with Canada in the vicinity of the northern reaches of Lake Champlain in Vermont. He worked in conjunction with a British astronomer in demarcating the 45th parallel of latitude and, through their observations, found that the boundary in that location was nearly a mile south of the old established line, by which an important American fort at Rouses Point was found to fall within British territory. This fort later came to be known as "Fort Blunder." But Hassler proved to be effective with his advice to treaty negotiators in pointing out the difference between geographic and geocentric latitude, the latter putting the American fort right back in the States where it belonged! As it turned out, the boundary line in that particular region never did become firmly established until the Webster-Ashburton Treaty was signed in 1842. Hassler's services on the Boundary Commission were discontinued in the spring of 1819 resulting from his exhortatory demands upon the U.S. Commissioner for salary and expenses, together with other extenuating circumstances.

Following this, Hassler decided it was time to commit to paper his thoughts on the need for geodetic surveys in the country and subsequently began compiling what later came to be published in *Transactions of the American Philosophical Society*, new series, 2 (Philadelphia, 1825), under the title *Papers on Various Subjects connected with the Survey of the Coast of the United States.* Included was his Plan of 1807 in its entirety. He even had a notion to take up agriculture as he had moved to Cape Vincent, New York, along the shore of the St. Lawrence River by 1819. This caused him to sell off many of his possessions from his previous home including a large portion of his remaining library to West Point. But most of his time was devoted to scientific study and writing. Finally, by 1824, he decided to take another teaching position; this one at Union Hall Academy on Long Island, one year after his wife of 23 years of marriage had left him to fend for himself, with the help of his grown children, on the farm. It was while on Long Island that he took up writing textbooks and saw his *Elements of Analytic Trigonometry* published in 1826. Once again, he became unemployed upon the closing of the Academy later that same year. He next took to private tutoring in Richmond so as to be closer to Jefferson's University of Virginia where he had for some time been applying for a professorship of Mathematics and Natural Philosophy. But this was to be of no avail as professors had already been selected and appointed, and, with Jefferson's death on July 4, 1826, his direct linkage to that institution was no longer a viable one. It was also during this period that Lieutenant Charles Wilkes of the U.S. Navy, who eventually became the leader of the first U.S. Exploring Expedition (1838-42), sought out Hassler for instruction in the methods of geodetic surveying to support his hydrographic operations. He finally returned to New York again in 1829 where he accepted an appointment as gauger in the New York Custom House. After living with Professor Renwick for a while, he was finally able to find a house and regain some semblance of family life with a number of his children. By 1816, his wife had borne him nine children, three of whom had died in their youth.

Fate once more began to smile on Hassler when, on November 2, 1830, President Andrew Jackson placed him in charge of regulating the standards of weights and measures in the United States - - this at a compensation of $3,000 per annum. Thus, during the period 1830-32, he devoted his efforts to a comparison of the various standards of length and weight in actual use in the custom houses of the United States. Hassler remained in charge of the work on weights and measures for thirteen more years until his death in 1843.

When on July 10, 1832, the Survey of the Coast was re-established on the basis of the Act of 1807, Hassler added to the above work, that of Superintendent of the Coast Survey. This modified organizational name was not officially adopted until March 27, 1836.

This has been a necessarily brief overview of the early period of the Survey's development and Hassler's role in its formation. Following the period 1818 to 1832, sometimes referred to as the "Dark Ages" of the Coast Survey, came the "Renaissance Years" from 1832 to 1843. I leave it to you to delve into the record of emerging growth of the "Nation's Chartmakers" and to learn of Hassler's continuing struggle for Congressional understanding and support - - a struggle that lasted right up to his dying day.

In closing, I would like to quote from the introduction to Cajori's *The Chequered Career of Ferdinand Rudolph Hassler,* as he so aptly states:

> "A man of great practical ability as a scientist, but of scant practical ability in the art of easy and comfortable living, a man highly trained in mathematics, yet a mere child in every-day economics, a man lacking the training of the ordinary politician, yet able by his earnestness and sincerity to influence public opinion, a true scientist ambitious for the higher standards of scientific achievement and never willing to surrender them to the pressing demands of temporary expediency - - such a man was Ferdinand Rudolph Hassler. This rugged figure commands a conspicuous position in the early history of science in America, as the organizer and first superintendent of the first great scientific bureau of the United States in Washington, D.C."

References:

Bloom, Sol. *The Story of the Constitution.* Washington, D.C.: United States Constitution Sesquicentennial Commission, 1937.

Cajori, Florian A. *The Chequered Career of Ferdinand Rudolph Hassler.* Boston: Christopher Publishing House, 1929.

Dupree, A. Hunter. *Science in the Federal Government: A History of Policies and Activities to 1940.* Cambridge, Mass.: Belknap Press of Harvard University Press, 1957.

Hassler, Ferdinand R. "Papers on Various Subjects Connected With the Survey of the Coast of the United States." *Transactions of the American Philosophical Society,* new series, 2, pt. 12 (1825): 232-420.

International Boundary Commission. *Canada and the United States Annual Joint Report 1983.* Washington, D.C.: Published under the joint authority of the International Boundary Commission, 1983.

U.S. Coast and Geodetic Survey, ed. *Centennial Celebration of the U.S. Coast and Geodetic Survey, April 5th and 6th, 1916, Washington, D.C.* Washington, D.C.: U.S. Government Printing Office, 1916.

U.S. Dept. of the Treasury. *Report of the Secretary of the Treasury, Communicating a Report of the Superintendent of the Survey of the Coast, Showing the Progress of the Work During the Year Ending November 1844.* United States Congress (28th, 2nd session). Senate Document 16. Washington, D.C., 1844.

Weber, Gustavus A. *The Coast and Geodetic Survey: Its History, Activities and Organization.* Service Monographs of the United States Government 16. Baltimore, Md.: Johns Hopkins Press, 1923.

Wilkes, Charles. *Autobiography of Rear Admiral Charles Wilkes, U.S. Navy 1798-1877.* Edited by William James Morgan et al. Washington, D.C.: Naval History Division, Department of the Navy, 1978.

2.5 *Hassler's First Chart*, by Captain Charles A. Burroughs, NOAA (Ret.), 1987

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HASSLER'S FIRST CHART

Charles A. Burroughs

Within the annals of history of the United States Coast Survey, there has long been some question as to the date of its first chart - - 1835, 1838, 1839 or 1844. This paper addresses that matter in the context of the role of that agency's first Superintendent, Ferdinand Rudolph Hassler.

In 1807, Congress authorized President Jefferson "to cause a survey to be taken of the coasts of the United States, in which shall be designated the islands and shoals, with the roads or places of anchorage, within twenty leagues of any port of the shores of the United States; and also the respective courses and distances between the capes, or headlands, together with such other matters as he may deem proper for completing an accurate chart of every part of the coasts within the extent aforesaid."

F. R. Hassler
1770-1843

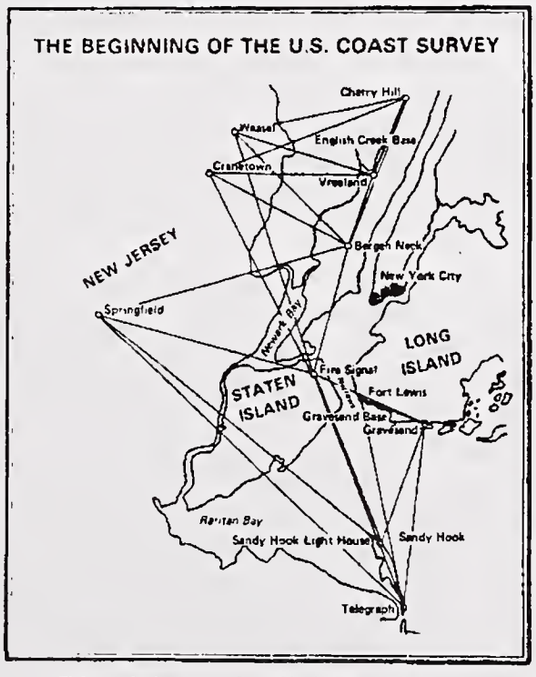
This Act of Congress was preceeded by a time in the Nation's history when maritime commerce was experiencing tremendous growth. Passenger ships and cargo vessels were entering and departing American ports for all parts of the world. The need for surveys of critical coastal areas and the production of adequate navigation charts was becoming paramount. Up to this time, only small scale charts existed, such as those produced by the Englishman Joseph F.W. DesBarres, Esq. between the time of the American Revolution and 1784, known as The American Neptune series. Although these were beautifully engraved and contained picturesque coastal views, their usefulness to mariners was limited due to their small scale and the fact that little provision was made for updating information contained therein. Generally, shipmasters were left to acquire their knowledge from the shipwrecks of others. By the turn of the century, a number of American commercial chartmakers began to appear, foremost being the firm of Edmund March Blunt (1770-1862). Although much of their information was simply compiled from the surveys and works of others, much from the U.S. Navy, the Blunts did eventually finance their own explorations and surveys. However, the need for an integrated, comprehensive coastal survey operation continued to come up before special committees of Congress.

Implementation of the Act of 1807 was assigned to Secretary Albert Gallatin, who promptly issued a circular letter requesting men of science to submit plans for carrying out such a "Survey of the Coast". In the meantime, a certain young Swiss gentleman recently had immigrated to Philadelphia, his objective being to establish a land colony in the southeastern states. Born on October 7, 1770, in the town of Aarau in the northern part of Switzerland, he had already distinguished himself as an accomplished geodetic surveyor, having completed a triangulation survey of the Canton of Bern by the turn of the century. His name was Ferdinand Rudolph Hassler, and in the summer of 1805, he had chartered the ship LIBERTY (350 tons), bound from Amsterdam to Philadelphia. He arrived in that bustling port city in September, bringing with him 120 Swiss immigrants and their families, together with his wife, their four children, and 96 trunks, boxes, and bales, that included 3,000 volumes of classical works in history, mathematics and natural philosophy. Also brought along were a number of instruments and standard weights and measures, including a standard meter, constructed in Paris in 1799 by the International Committee of Weights and Measures. However, upon his arrival, the land colony did not materialize, as one of the advance agents had speculated with the funds. Thus, Hassler immediately fell into financial straits and was forced to sell off a portion of his library in order to provide for his family.

It was during this period that Hassler came into contact with the leading scientific men in this country and was soon elected a member of the American Philosophical Society in Philadelphia. Through this affiliation, he was requested to prepare his own plan for the Survey of the Coast in response to Gallatin's request. Within two weeks, he forwarded his response, comprising 6½ pages written in French, outlining his ideas in great detail including the nature of the land surveys required to support such a coastal survey, the types of instruments and measures to be employed, and the kinds of station markers to be used in order that the ground stations could be recovered for future survey operations offshore. By this time, he had been appointed Professor of Mathematics at the Military Academy at West Point, New York.

Of the many plans submitted, including one by James Madison, Hassler's was accepted by President Jefferson on July 21, 1807. But the initial appropriation of $50,000, earmarked for the purchase of instruments and other supplies needed for the survey, was held in abeyance "because of the political disturbances in Europe and America." The Act itself mentioned no department but placed the Survey directly under the President. The Treasury Department eventually took up the work of the organization because of its concern for lighthouses, because it was the most highly developed executive department, and because Secretary Gallatin was both Swiss and a man of scholarly tastes. Hassler's professorship at West Point was terminated on December 31, 1809, resulting from a dictate by the new Secretary of War stating that "no law authorizes the employment of civilians at West Point." By the summer of 1811, Secretary Gallatin was finally able to take up the work of the Coast Survey and Hassler was sent on a mission to London to obtain the requisite instruments. Of the many instruments and standards of measure procured, many were custom made according to Hassler's own specifications and under his watchful eye. Four years later, somewhat due to the interruption of the War of 1812, but largely due to Hassler's own fastidiousness, the collection was packed and ready for shipment and declared, even in Great Britain, to be the best of its kind that ever left England.

On August 3, 1816, Hassler received his official notification of appointment as "Superintendent of the Survey of the Coast" and was busily engaged in his first reconnaissance survey work with the assistance of three young cadets from West Point. Subsequently, he was able to obtain two valued assistants, Major J.J. Abert and General J.G. Swift of the U.S. Topographic Engineers. By early spring of 1817, he had constructed a unique carriage, especially designed to transport his delicate but otherwise unwieldy instruments and ancillary equipment. A principal element of the survey was to form a chain of triangles, with sides about thirty miles in length along the entire coastline, determining the direction from true north of their sides and the latitude and longitude of their angular points. Another series of triangles about ten miles along each side, to provide an ample number of known points to which the survey could be referred in all its detail, were to be contained within the larger triangles. The entire network was to rest upon two baselines, strategically situated, and to be measured with an accuracy to be obtained by methods and equipment as experience dictated. Such baseline measurements serve to provide scale and orientation to the triangulation network. Through trigonometry, a progression of computations can then be made for latitude and longitude for each angular point.



Triangulation near New York City 1816-1817

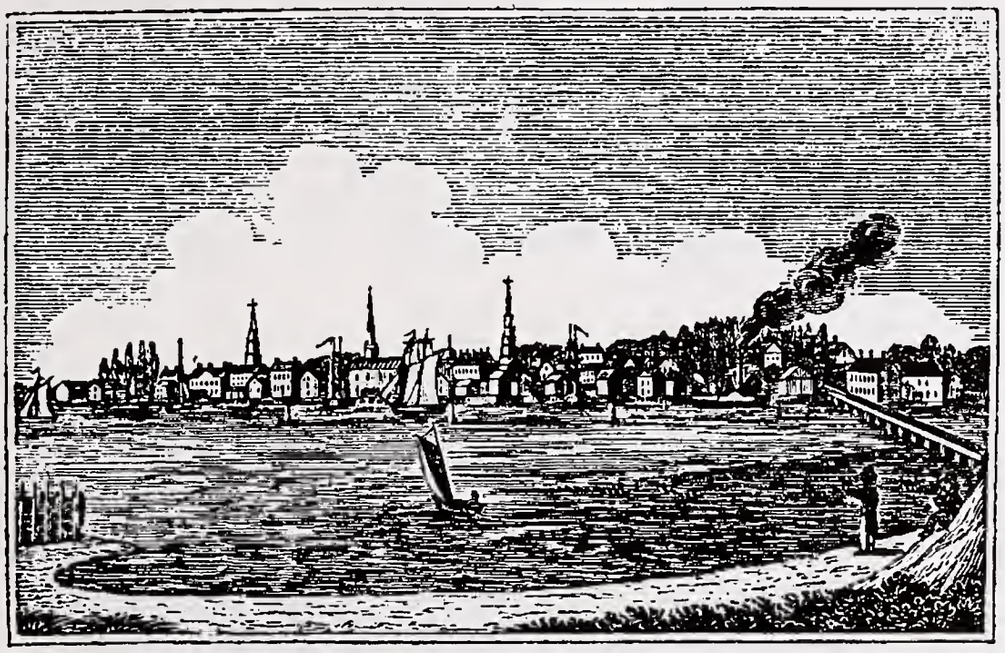
Notwithstanding his industrious start, with minimal resources and given the vagaries of the northeast weather, Congress was so upset with the minimal progress shown by the spring of 1818, that the law authorizing the Survey of the Coast was repealed, so modified that only military and naval officers could be employed by the Survey. This ushered in the "Dark Ages" of the Coast Survey. During this period, Hassler busied himself with various projects and activities, from taking up the boundary line survey with Canada, upon President Monroe's request, to trying his hand at establishing an agricultural community in northern New York, to documenting the need for geodetic and coastal surveys of the United States through the Transactions of the American Philosophical Society. He also devoted time to writing school textbooks that included his Elements of Analytical Trigonometry, published in 1826. Hoping to gain a professorship of Mathematics and Natural Philosophy at Jefferson's University of Virginia, he even took to private tutoring in Richmond. But this was to no avail as professors had already been selected and appointed. It was also during this period that Lieutenant Charles Wilkes of the U.S. Navy, who later became the leader of the first U.S. Exploring Expedition to the South Seas (1838-42), sought out Hassler for instruction in the methods of geodetic surveying to support his own hydrographic operations. He finally returned again to New York City in 1929, where he accepted an appointment as gauger in the New York Custom House.

Fate once again smiled on Hassler when, on November 2, 1830, President Andrew Jackson placed him in charge of regulating the standards of weights and measures in the United States. During the period 1830-32, he concentrated his efforts on a comparison of the various standards of length and weight in actual use in the custom houses of the United States. Hassler remained in charge of the work on weights and measures for thirteen years until his death. When on July 10, 1832, the Survey of the Coast was re-established on the basis of the Act of 1807, Hassler was able to add to this work that of Superintendent of the Survey once again. The coast of Florida was, by then, added to the territory to be surveyed.

Thus, at the age of 62, Hassler again took up the work of the Survey under the Treasury Department. Triangulation surveys were extended to the eastward out over Long Island and along the Connecticut coastline as an extension of the original network. Improved methods of baseline measurement were employed yielding even greater accuracy to the resultant survey than that obtained in the earlier work. By March 1834, ostensibly because the Treasury had become overwhelmed by other concerns, the Survey was once more transferred back to the Navy Department, where it had been under caretaker status from 1818 to 1832, with very little accomplished in advancing the work in an orderly manner. But this time, Hassler was left in charge and the civilian employees were retained. Two years later, in March 1836, the Survey was restored again to the Treasury Department at Hassler's insistence and the name was changed from "Survey of the Coast" to "Coast Survey".

Activities increased steadily during this period until Hassler's death in 1843. Improved organization, planning and systemization of the work allowed Hassler to train numerous new assistants. Through his increased delegation of responsibility, the scope and extent of the work was materially expanded. Navy officers and Army topographic engineers were regularly detailed for duty with the Survey. Edmund Blunt, son of the commercial chart publisher, was appointed in 1833. In addition to the field parties engaged in astronomic and geodetic observations, hydrographic work increased markedly from 1834 onward. Included was the study of tides and currents and, eventually, magnetic observations were added to further aid the mariner. The ground work also was laid during this period for the compilation and production of maps and charts, as chart paper of the correct grade, copper plates of the right material and properly fabricated, and even several trained engravers, all had to be imported from abroad.

The Survey's earliest hydrographic field work was conducted along the south coast of Long Island by Lieutenant T.R. Gedney, U.S.N. (Great South Bay, Conklin's Point to Green's Point, 1834). This was followed the next year by increased hydrographic survey activity in Long Island Sound and the approaches to New York Harbor.

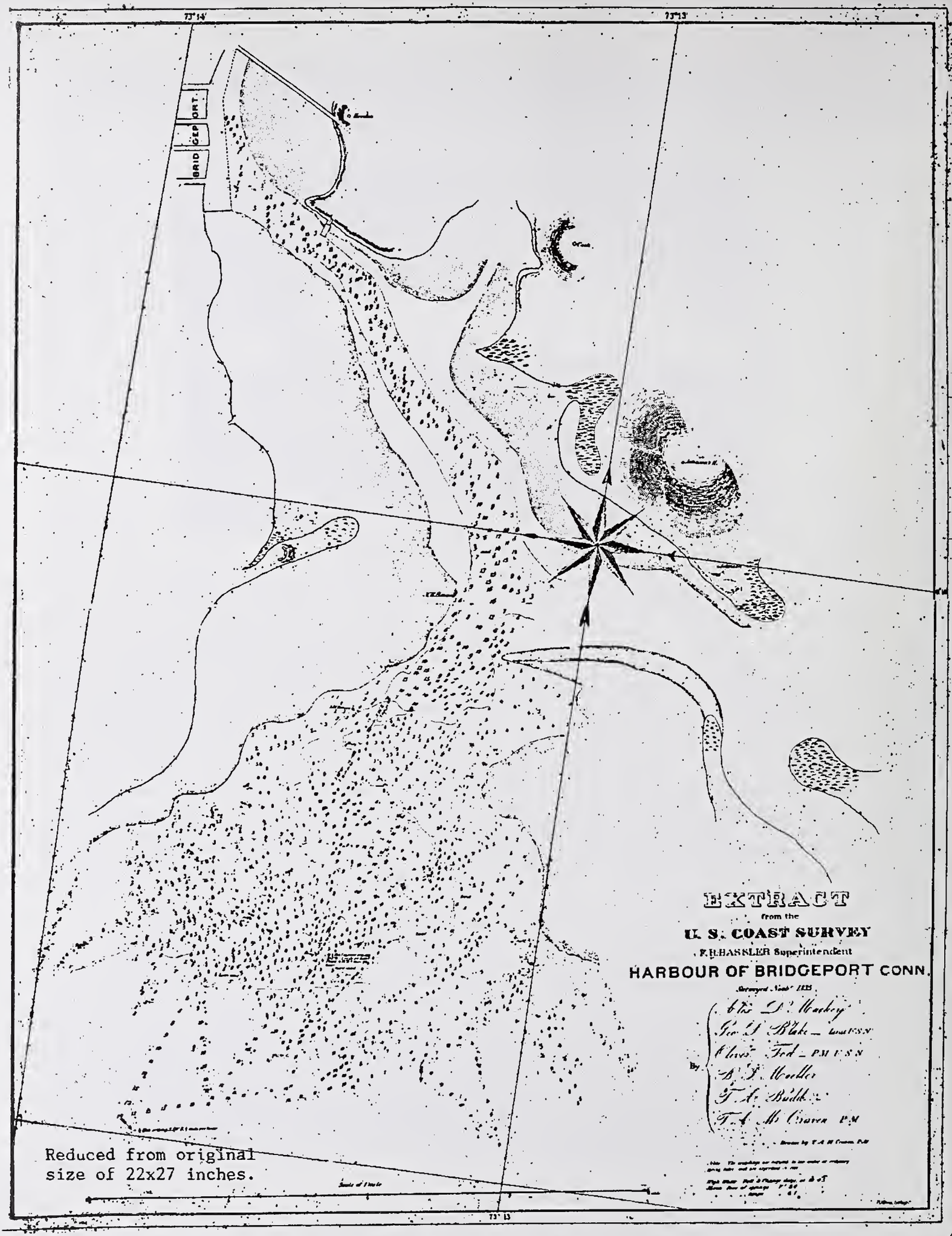


East view of Bridgeport, (1834.)

(From Connecticut Historical Collections, by J.W. Barber, 1836)

However, it was Lieutenant George S. Blake's survey of Bridgeport Bar & Harbor, along the north shore of Long Island Sound, that resulted in the first actual chart construction under Hassler, based upon the field survey work. This "EXTRACT from the U.S. Coast Survey, F.R. Hassler Superintendent, HARBOUR OF BRIDGEPORT, CONN., Surveyed Novbr. 1835" appears in conjunction with Document No. 210, bound in with Senate Documents, Vol. 3, for the 1st Session of the 24th Congress, 1835-36. Privately printed, it was transmitted to the Hon. Martin Van Buren, President of the United States by the Hon. Mahlon Dickerson, Secretary of the Navy Department, on February 25, 1836, under whose control the Survey was then operating. The transmittal was accompanied by a letter from Lieutenant Blake, explaining the nature of the chart and drawing attention to the dangers of the two bars obstructing the entrance to the harbor. The survey and resultant chart were apparently made in response to a Senate Resolution calling for the excavation of a channel across the bars to allow passage of deeper draft vessels than previously could be accomodated. Quoting from Blake's letter:

> " - - - It will be seen by the chart that the entrance to this harbor is obstructed by two bars, the deepest water across the outer one at low tides being 4.8 feet, and the inner one 6 feet. Between these bars there is safe anchorage for vessels drawing 10 feet water, and within both of them there is a perfectly secure and commodious harbor for vessels drawing 13 feet. - -
>
> " - - - For the utility of the improvement (excavation of channel), it may be said that the commerce of Bridgeport, notwithstanding the obstructions to the harbor, is considerable. The shipping owned in the place, I was informed, amounts to nearly two thousand tons; a portion of which is in the whaling business, although the vessels so employed are compelled to lie at an exposed and highly dangerous anchorage without the outer bar when receiving or discharging their cargoes. - - - "



Courtesy of the U.S. National Archives, Cartographic and Architectural Branch (RG77, K29).

MAP

of

NEW-YORK BAY AND HARBOR

AND THE ENVIRONS.

Founded upon a Trigonometrical Survey

under the direction of F. R. HASSLER Superintendent of the

SURVEY OF THE COAST OF THE UNITED STATES

Triangulation by JAMES FERGUSON and EDMUND BLUNT Assistants

The Hydrography

under the direction of THOMAS R. GEDNEY Lieutenant U.S. Navy

The Topography

by C. RENARD and T.A. JENKINS Assist.ts

Scale $\frac{1}{30,000}$

Sheets N.os 1 2 3 & 4 Verified by C.M Eakin Assistant & Published in 1844.

Sheets N.os 5 & 6 Verified by Lt. A.A Humphreys Assistant & Published in 1845.

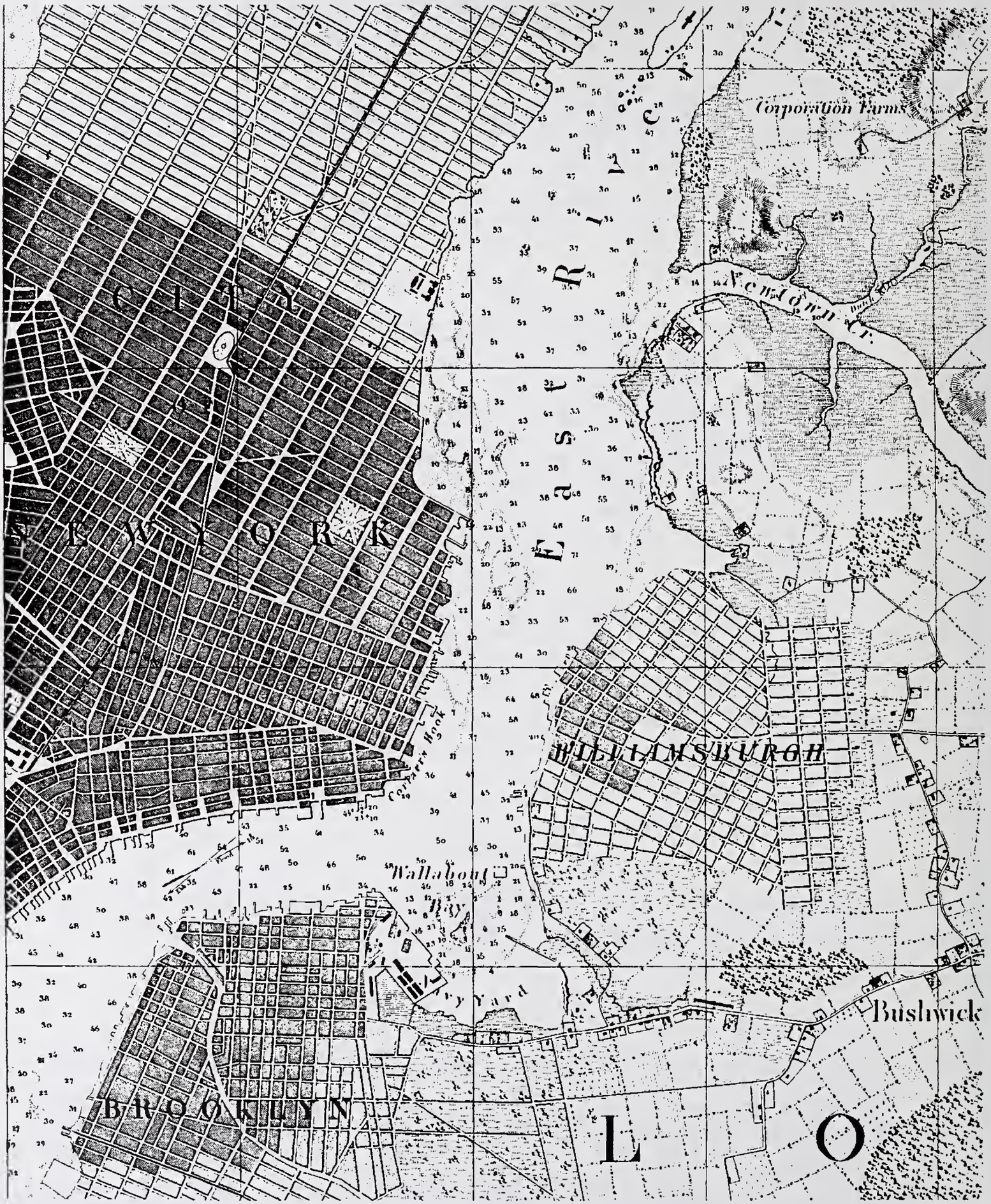
Variation of the Magnetic Needle *at Sandy Hook in January 1844 5°.5 West*

Longitude of New York City Hall *West of Greenwich observatory 74°*

Price 25 cents per sheet.

The first chart made entirely by the Coast Survey was assembled from six sheets. Parts of two sheets are reproduced here at full scale (1:30,000). One is the title block, and the other is a map of a portion of New York City and adjacent towns.

Courtesy NOAA, National Ocean Survey.


Corporation Farms
Newtown Cr.
East River
CITY
NEW YORK
WILLIAMSBURGH
Corlaers Hook
Wallabout Bay
Navy Yard
Bushwick
BROOKLYN
L O

Similar surveys were made, also with charts privately printed, for New Haven Harbor (Blake, 1838) and Newark Bay (Gedney, 1839). But it wasn't until after Hassler's death that the very first "classic" Coast Survey chart appeared for general distribution to the public: New York Harbor (1844 & 1845), at a scale of 1:30,000. This six sheet version, bearing Hassler's name as Superintendent, measures 63" x 64". The same area was covered by a chart published in 1845 in one sheet (24" x 35") at a scale of 1:80,000 under the name of Hassler's successor, Alexander Dallas Bache. Both issuances were the first charts to be entirely produced by Coast Survey personnel.

Author's Note:

This article is largely biographical in keeping with the author's desire to heighten public awareness to the contribution of geodetic control surveys in America by F.R. Hassler. It draws heavily from a paper, "F.R. Hassler: First Superintendent", presented by Captain Burroughs earlier this year at the "Symposium on the 180th Anniversary of the Founding of the Survey of the Coast", held in Rockville, Maryland on February 26. Further, it is in line with his efforts, solely through voluntary private contributions, to restore the Hassler Memorial, located in one of the Nation's earliest garden cemeteries on the outskirts of Philadelphia. The project is being sponsored by The Coast & Geodetic Survey Society, founded in 1978 by former C&GS employees to keep the name of this proud organization alive in a fast changing world. The American Philosophical Society in Philadelphia also is lending its support to this worthwhile project.

REFERENCES

Cajori, Florian, The Chequered Career of Ferdinand Rudolph Hassler. Boston, The Christopher Publishing House, 1929.

Guthorn, Peter J., United States Coastal Charts, 1783 - 1861. Schiffer Publishing, Ltd., 1984.

Price, Thomas M., Jr., The First Thousand Years of Finding New York. USC&GS Field Engineers Bulletin, No. 12, December 1938.

Stanley, Albert A., NOAA (Reprint), "Hassler's Legacy". Vol.6 No. 1, January 1976.

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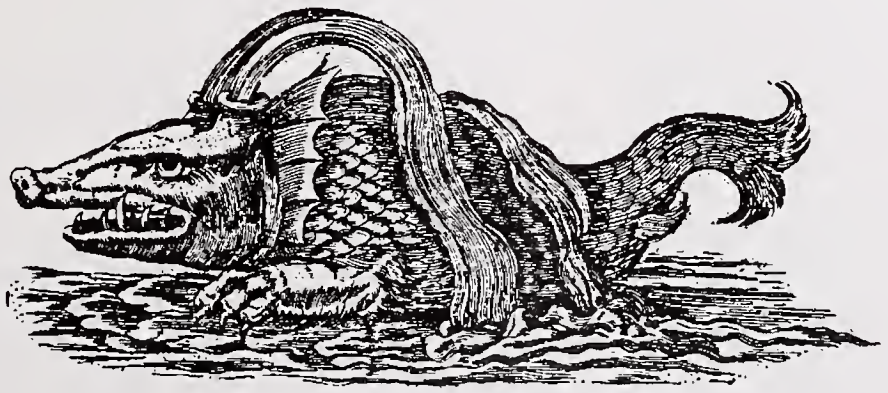
H. Rep. Docs. 182, 202, 25th Cong. 3d Sess. (1838-39).

National Ocean Survey Historical Cartobibliography II: Age of Exploration, November 1982.

Sen. Doc. 210, 24th Cong. 1st Sess. (1835-36).



2.6 *History of Geodetic Surveying: Part 1, The Early Years, 1807-1843*, by Joseph F. Dracup, 1995

Reprinted with permission from: ACSM Bulletin (American Congress on Surveying and Mapping), no. 154 (March/April 1995): 15-19.

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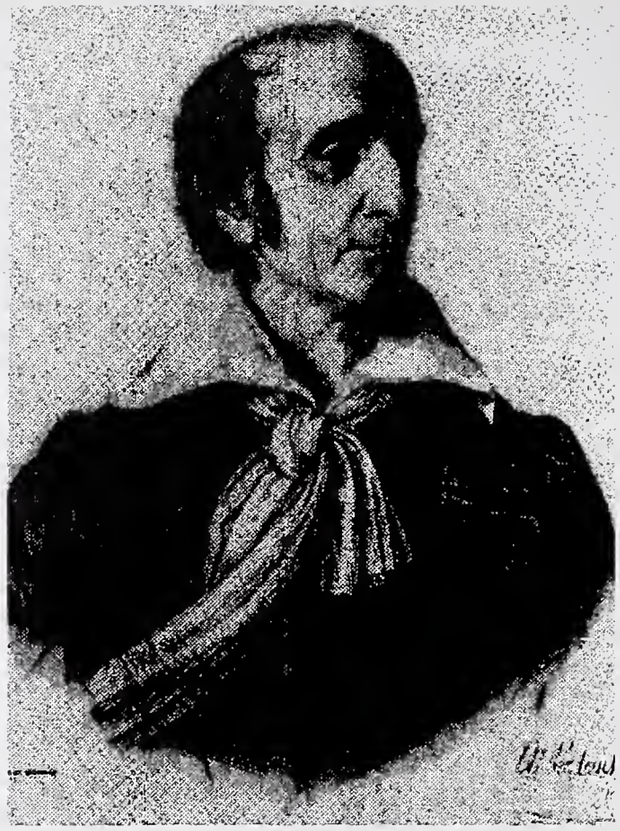


F.R. Hassler, Superintendent of the U.S. Coast Survey, pictured in 1841.

History of Geodetic Surveying

by Joseph F. Dracup

The United States began geodetic surveys later than most of the world's major countries, yet its achievements in this area are immense and unequaled elsewhere. Most of the work has been done by a single agency. That agency began as the Survey of the Coast in 1807, was identified as the Coast Survey in 1836, was renamed the Coast and Geodetic Survey in 1878 and, since about 1970, has been the National Geodetic Survey, presently a division in the National Ocean Service, NOAA.

This four-part series is a look at the geodetic work of the Coast and Geodetic Survey, which has been with us, under one name or another, for nearly 190 years, along with the scientific accomplishments, technological developments, major and other interesting events, ancedotes, and the contributions made by the people of each period.

Part I concerns the early years of geodetic surveying in this country. Subsequent issues will cover:

- Part II—Laying the Foundations of the Networks, 1843-1900
- Part III—Building the Networks, 1900-1940
- Part IV—Dawn of a New Era, 1940-1990.

48

Part I
The Early Years: 1807-1843

The early period was dominated by Ferdinand R. Hassler, who developed the plan, gathered the instruments and technical books, made all the primary observations himself, and set the standards of excellence that became the hallmark of geodetic surveys in the United States.

Early Geodetic Surveys

The British/French Controversy

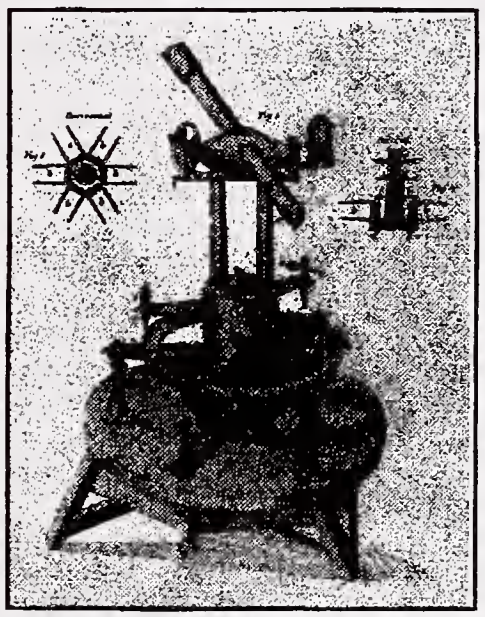
The first geodetic survey of note had been observed in France during the latter part of the 17th century and the early 18th century. Jean Picard began an arc of triangulation near Paris in 1669-70 and continued the work southward until his death about 1683. His work was resumed by the Cassini family in 1700 and completed to the Pyrenees on the Spanish border prior to 1718, when the northern extension to Dunkirk on the English Channel was undertaken.

The survey created a major controversy, for the results indicated that the earth was a prolate ellipsoid, which contradicted Issac Newton's 1687 postulate that it was an oblate figure. To settle the hue and cry that followed, the French Academy of Sciences in Paris proposed in 1733 that the length of the meridian be measured near the equator and compared with that obtained in France. Later it was decided to do the same in the Arctic region. The Torne River valley north of Tornio in Lapland, on the Swedish-Finnish border, was chosen as the northern site; observations were begun in 1736 and completed two years later. The results showed conclusively that one degree of the meridian was longer in Lapland than at Paris and proved Newton's postulate to be correct. The expedition to Peru (to a location in present-day Ecuador) departed in 1735 and returned nine years later with results that confirmed the Lapland finding, i.e., one degree of the meridian is shorter at the equator than in France.

These truly remarkable efforts by the French and their associates were carried out with instruments which would seem very primitive in comparison with equipment available 50 years later, though they were the best then available. Furthermore, the observations were secured under extreme conditions especially in the high Andes of South America. In Peru, the angle observations were made with quadrants having 2-3 feet radii and two telescopes—one fixed, the other moveable—and equipped with micrometers for finer readings, the latter used perhaps for the first time. The horizon was closed on each set of observations and usually involved six or seven angles. The average closing error was on the order of 2 minutes, indicating the accuracy of each angle at 20″ to 30″. Baselines in Peru were measured using wooden rods, each 20 feet long, and were standardized daily or more often with an iron toise (about 6.4 English feet) that was carried along and kept in the shade. The baseline in Lapland was measured over the frozen Torne River using a similar, although longer (33-foot), apparatus.

Great Britain

Great Britain began geodetic surveys in 1784 under the direction of Major General William Roy. A site for the first baseline, about five miles in length, was selected on Hounslow Heath in what is present-day west London. The initial measurement was made using rods of Riga pine. Large errors were noted between measurements made, depending on whether the rods were wet or dry, and so the line was remeasured with glass tubes constructed by Jesse



Twenty-four inch theodolite No. 2, made in England by Troughton in 1814. (Reproduced in Centennial Celebration of the United States Coast and Geodetic Survey 1916 *from the* Transactions of the American Philosophical Society, 1825, *and reproduced here with the permission of the National Geodetic Survey, NOS, NOAA.)*

Ramsden. After 1791, baselines were measured with 100-foot steel chains. Jesse Ramsden's theodolite, with a 3-foot circle reading to 1″ built in 1787, was used for the angle observations and, despite its 300 lbs. or so weight, good progress was obtained in the triangulation, including a connection between Dover and France in 1787. Roy died in 1790 and, after a delay of about one year, the triangulation was resumed and completed in 1822. (Between 1936 and 1950 a new, denser network with ties to several points of the earlier triangulation was observed.)

Ramsden's Direction Theodolite

Ramsden's direction theodolite is among the four or five greatest tech-

nological advances ever in geodetic surveying. Prototypes continue in use in almost all countries. In the field of general surveying, however, the invention (in around 1790) by the French of the repeating theodolite is of equal importance, because it is the basis for the instrument which most surveyors have employed. Despite their almost universal use in the private sector, repeaters have been shown to be less accurate than direction instruments. Although in theory the opposite is the case, in practice, repeaters' more moveable parts and the mechanical motions required to operate them contribute to larger error sources. As for the French, as you might expect they still preferred repeating theodolites for higher order surveys, and continued to use them as late as 1963 when a new connection was made between Portsmouth, England and Cherbourg, France. Instruments employed that year were repeating types, presumably reading to 1" with eye pieces having moveable cross hairs, so that as many as 10 readings could be obtained from each pointing. One point of interest. The new Portsmouth/Cherbourg connection was only possible because Bilby towers were available.

First Level Datum

As might be anticipated, The Netherlands established the first level datum in 1682 and carried out surveys along rivers and some shorelines between 1797 and 1812. However, the first geodetic leveling was not begun until 1875. By contrast, Great Britain started their geodetic leveling in 1841 and completed it about 20 years later. In almost all instances, geodetic levelings were undertaken after the triangulation was well on its way or completed.

By 1800, most of the countries of Europe had drawn up plans or were on their way to establishing triangulations. By 1842, these triangulations spanned the continent from the Mediterranean Sea on the south to the Arctic regions on the north, and from Ireland, England and the Atlantic Ocean on the west to the interior of Russia on the east.

Hassler Leads U.S. Effort

The United States entered this world of geodesy in 1807 and, while 25 years passed before the primary work could be initiated, its achievements were soon recognized by much of the world. At the beginning and along the way for 25 years, however, there were many trials and tribulations to be overcome. The country was very fortunate indeed that a man of the caliber of Ferdinand R. Hassler was selected to lead the effort, for one of lesser resolve would have given up early, given the many and difficult problems. Hassler was 37 years old when he was named the first superintendent of the Survey of the Coast and 62 when he began the first major triangulation in 1832. There were many depressing and disillusioning periods for him in the intervening years.

1807: Survey of the Coast Created

Geodetic surveying began in the United States on February 10, 1807 with the creation of the Survey of the Coast by Congress during the presidency of Thomas Jefferson. Hassler, a Swiss-born geodesist who had conceived the plan for the agency, was placed in charge and served in that capacity on and off until his death in 1843. Nothing was accomplished for several years because appropriated funds were not released due to political opposition and unsettled conditions in Europe, the source of needed equipment. Finally in 1811, $25,000 was disbursed and Hassler immediately went to England to have instruments made to his design and specifications, and to purchase other equipment and scientific books. He remained there during the War of 1812, returning in 1815.

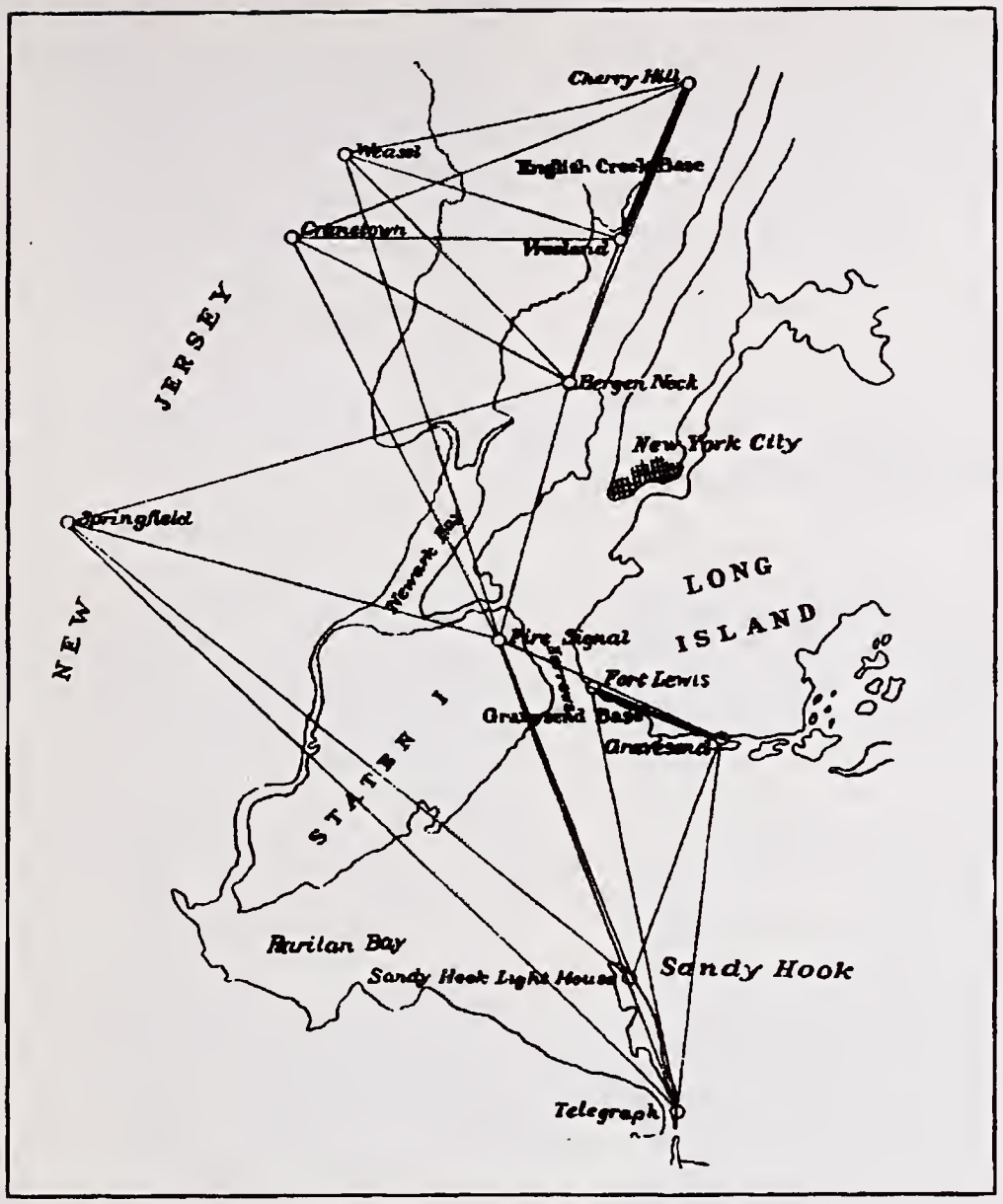
First Field Surveys

First field surveys were carried out in 1816-17 near New York City, where a small scheme of triangulation consisting of 11 points, scaled by two measured baselines, was accomplished to an accuracy that would approach present day second-order, Class I. Hassler performed the reconnaissance to select the station sites, directed the baseline measurements, and observed all the angles with the recently acquired 24-inch theodolite, built by Edward Troughton of London to Hassler's specifications.

The first point occupied for geodetic observations in the U.S. was identified as WEASEL, located on a low mountain about two miles south of Paterson, New Jersey on July 16, 1817. It was marked by a 6" deep drill hole filled with sulphur. In 1934, it was reported that the top of the mountain had been blasted off, destroying the station. Blasting is one of the very few ways to obliterate a mark of this type. None of the original stations are thought to exist today, although WEASEL and SPRINGFIELD were included in the primary triangulation southward from New York City observed in 1838. Station CHERRY HILL, one end of the baseline at the northern end of scheme, near Englewood, New Jersey was destroyed by subdivision construction in the late 1970s, only a few days before personnel were scheduled to move the point to a protected area. In 1987, the American Society of Civil Engineers placed a plaque at the approximate location of original station CRANETOWN, north of Montclair, New Jersey, noting the site as a National Historic Civil Engineering Landmark.

Hassler Dismissed

Almost immediately on its completion, politics reared its ugly head once again and Hassler was dismissed. For about 15 years he tried his hand at several occupations before being reappointed to his position in 1832. First he worked as an assistant on the U.S.-Canada northeast boundary surveys, then made an unsuccessful attempt at farming in a remote site on the St. Lawrence River, where his wife left him. After that he took a position as a gager at the New York Custom House, followed by a period of unemployment during which he wrote several books on advanced mathematics and devel-



Hassler's first field work, 1816-17.

oped the polyconic map projection still used today. Finally, in 1830, he received an appointment as superintendent of the new Office of Weights and Measures. This office remained in the Coast and Geodetic Survey until 1901, when it was spun off to become the National Bureau of Standards. This was a dark period for both Hassler and American geodesy.

Hassler Reappointed

Once back on the job, Hassler immediatedly began geodetic surveys on Long Island, New York that have continued, more or less unabated, until today. The instruments and equipment that Hassler had made or purchased were more than adequate for the task at hand. This was attested to by a French astronomer who said in 1832 that at the time of construction, the instruments were 20 years in advance of the science of Europe. Having the best of tools is no guarantee, of course, of the best of results. In surveying, "best" means the most accurate and to reach that goal requires, in addition to the instrumentation, trained and conscientious personnel and proper observing procedures. The sum total of all the requirements can be broadly categorized as standards of accuracy, and Hassler set standards of the highest accuracy for these early surveys that remain the hallmark of American geodetic work. He made all the observations at the primary stations himself, while at the same time training his assistants James Ferguson and Edmund Blunt on the secondary surveys so that they could step in when necessary to do his job—which they did. The first station occupied was BUTTERMILK on June 11, 1833. It still exists and is located on what is now the Rockefeller estate in Westchester County, New York.

The Great Theodolite

Prior to October 18, 1836, the observations were made using the 24-inch theodolite. On that day and until his death in 1843, Hassler employed a 30-inch instrument that he proudly called the Great Theodolite. Designed by Hassler and built by Troughton, this, the finest instrument of its day, was used first at station WEST HILLS on the northern shore of Long Island, a point that remains in place even now. The Great Theodolite's weight of 300 lbs. was of little concern to Hassler, who had used a 36-inch Ramsden theodolite, an instrument of similar weight, in the trigonometrical survey of Switzerland. He simply strengthened the oversize carriage used for transporting the 24-inch instrument, a fairly heavy piece in itself, weighing perhaps 200 lbs.

Two characteristics of the Great Theodolite are seldom mentioned. Firstly, it was designed as a repeating instrument, and, second, it had a 24-inch vertical circle. Hassler employed it in the direction mode as did others later, until it was destroyed in 1873. Presumably, the final construction was as a direction theodolite.

Hassler's Methods

The two baselines measured for the 1816-17 survey at Gravesend Bay near present-day Coney Island (4.7 miles) and at Englewood, New Jersey (5.8 miles), were not considered accurate enough nor probably long enough to scale the primary triangulation then underway. Both bases were measured with iron chains, each link one meter in length. Accordingly, Hassler measured his only pri-

mary baseline at Fire Island on the south shore of Long Island in 1834 using four two-meter iron bars laid end to end. It was not a direct measurement. In order to take advantage of the level beach, the principal measurement followed a route from WEST BASE somewhat southerly of the direct line to a point about 255 meters west of EAST BASE. The point was connected to EAST BASE by angle and distance with the distance between the terminals obtained by computation.

Hassler's methods were acclaimed by several scientific societies, but as always the real proof of the pudding lies in the agreements with the nearest baselines as computed through the triangulation. The checks were excellent, about 1:100,000 with the MASSACHUSETTS base, EPPING base (Maine) and KENT ISLAND base (Maryland), measured in 1844, 1857 and 1844 respectively and to about the same accuracy with nearby EDMI lines later observed in the 1970s.

Hassler's base apparatus was used for the MASSACHUSETTS and KENT ISLAND bases. The EPPING base was measured with Bache-Wurdemann compensating equipment. The base is 8¾ miles in length and marked at the terminals by red sandstone monuments 4 feet high and about 1 foot square with a rounded top, and at intervals of 2,000 meters by stoneware cones. Records state that the marks are lost, though it is unlikely that much of an effort was made to find them, especially the intermediate ones. With today's equipment it wouldn't take a huge effort to settle the question once and for all time.

The FIRE ISLAND base was computed through the triangulation to the line WEST HILLS-RULAND on the north side of Long Island, a line Hassler called his mountain base, from which the triangulation east and north and to the south was extended. This triangulation eventually ran from Calais, Maine southward to Dauphin Island near Mobile, Alabama then westward to New Orleans, Louisiana: a distance of 1,623 miles, with the field work done between 1833 and 1898.

Massachusetts Commonwealth Survey

The Coast Survey was not the only agency establishing triangulation at the time. In 1830 the Massachusetts legislature decided to prepare maps of the Commonwealth based on a trigonometric survey. Colonel James Stevens was placed in charge and began operations including the measurement of a 7.4 mile base line along the Connecticut River, near Northampton.

The measurement was carried out with compensating apparatus 50 feet in length designed by Dr. Joseph Rice. (The first application of the compensation principle had been by the Ordnance Survey of Ireland on the Lough Foyle base in 1827.) Rice's use of the compensation principle was about 15 years ahead of its use in the Coast Survey, albeit his work was known there. No other information is available about Rice and little is known about his apparatus although the methodology was reported in one or two scientific journals.

A theodolite on loan from the Coast Survey was used for angle observations until its recall in 1834. After that time an instrument of the Massachusetts surveyors' own design was employed.

Stevens resigned in 1834 and Simeon Borden, formerly an assistant, took over with the bulk of the work still to be done. The survey was completed in 1838. The results were not published until 1846 and the positions were given as tangent plane coordinates based on the location of the points in one of five zones. This was the first use of plane coordinates on a large scale in America. In 1935 it was reported that little use was made of the coordinate system, a situation not too different from that found today.

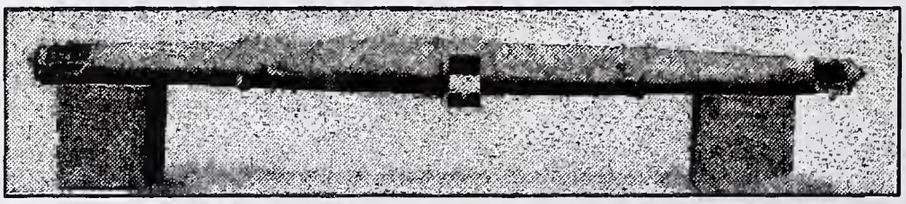
A Series of Name Changes

Hassler began using the title Superintendent of the Coast Survey in his 1836 report to the Secretary of the Treasury, the year the bureau was transferred to that department. This usage continued until 1865 where that and subsequent reports to 1877 show United States Coast Survey. In 1878 Congress changed the name to U.S. Coast and Geodetic Survey (C&GS); in 1899 the U.S. was dropped. In the 1970s, the C&GS became the National Ocean Survey (NOS), later renamed the National Ocean Service (NOS) with the geodetic functions assigned to the National Geodetic Survey (NGS), presently a division in NOS.

The End of the Beginning

Hassler continued observing the triangulation southward and after about 10 years only had reached southern New Jersey, involving but 24 stations. Upon completing the observations at station BURDEN he traveled to a station site in Delaware where during a severe storm he fell trying to protect his instruments and was badly injured. He returned to his home in Philadelphia where he died on November 20, 1843.

Thus we reach the end of the beginning. The groundwork for laying the foundation was done. By the turn of the century, triangulation would span the nation north to south from Maine to Louisiana, east to west from New Jersey to California, over the Great Lakes, and with work underway through the middle of the country between the Rio Grande and Canada.



Bache-Wurdeman compensating base apparatus. (Reproduced in Centennial Celebration of the United States Coast and Geodetic Survey 1916, *and reproduced here with the permission of the National Geodetic Survey, NOS, NOAA.)*

3. Rededication of the Renovated Hassler Memorial Monument, Laurel Hill Cemetery, Philadelphia, Pennsylvania, September 18, 1993

3.1 Overview

The Hassler Memorial Monument, located near, but not over, F. R. Hassler's gravesite at Laurel Hill Cemetery was restored in 1993. It was originally erected some years after Hassler's death by civilian assistants of the Coast Survey and officers detailed to the Survey from the Army and the Navy. The exact year of its creation is unknown.

Captain Charles A. Burroughs led the restoration effort and raised funds for the project from over 150 private donors. Major contributors were members of the U.S. Coast and Geodetic Survey Society (an alumni association within NOAA), the Standards Alumni Association (alumni association of NIST), the American Philosophical Society, the American Congress on Surveying and Mapping, the American Society of Civil Engineers, the Swiss-American Historical Society, the Friends of Laurel Hill Cemetery, the Hassler family, and other interested parties.

Restoration work included repair of the monument and the installation of a replacement tablet, carved after the original by a stone-carver from the firm of Harvard C. Wood Memorial Works. The original tablet was sent to NOAA, and later to NIST where it was eventually installed in the main lobby (see Section 5).

The rededication ceremony was held in two parts. Part one was held at the cemetery where the new monument was unveiled. Nearby, a musician played the Swiss alpenhorn in traditional Swiss dress. Later in the day, a speaker's program was held at the American Philosophical Society. This location was especially fitting as Hassler's body lay in state here following his death on November 20, 1843. He had been elected as a member of the Society in 1807. The presentations included here were part of the speakers program.

On the left, the monument before renovation. The urn had broken off and the tablet was severely eroded. At right, the renovated monument in 1993 with original urn refurbished. Repairs were made, and a replacement tablet was carved and installed. (Photograph on left: from the collection of the Hassler family. Photograph on right: from the collection of Charles A. Burroughs)

3.2 Message from the Swiss Federal Office of Metrology

The following message was sent via telefacsimile to the Standards Alumni Association.

Rededication of the Renovated Hassler Memorial Monument

Saturday, September 18, 1993

The Swiss Federal Office of Metrology wishes to express full appreciation and support to the promoters and organizers of the forthcoming event in memory of Ferdinand Rudolph Hassler, founder of the United States Coast Survey and the United States Office of Weights and Measures. We are gratified by the attention the American Philosophical Society and other organizations are paying to the eminent work of Hassler. He was a Swiss scientist, who emigrated to Philadelphia in 1805 due to unfavorable conditions in his home country.

Hassler was taught and greatly influenced by Johann Georg Tralles, a professor of mathematics and physics in Berne and the most important innovator in the Swiss Weights, Measures and Survey organization at that time. From this collaboration, Hassler brought with him to the United States a rich experience in measurement and survey sciences as well as a number of instruments. Among them were a standard meter and a standard kilogram, both made by the Committee of Weights and Measures in Paris. From there came the spark of revolution in measurement systems for uniform use throughout the world.

Hassler well personifies the aims at the present Swiss Federal Office of Metrology. Even if a physical monument is not given to him in his country of birth, the spirit in which he worked is fully alive here. From Switzerland, therefore, we send you enthusiastic support for your memorial and the associated ceremonies. We are planning to inform the metrology community and the wider public of this country so that they may fully appreciate the great and well deserved honor you assign to the happy memory of Hassler's contributions to science, technology, trade and understanding throughout the world.

Swiss Federal Office of Metrology.

[Signed]

The Director:
Dr. Otto Piller

The Deputy Director:
Dr. Wolfgang Schwitz

3.3 *The Office of Weights and Measures*, by Dr. Carroll S. Brickenkamp, Chief, Office of Weights and Measures, NIST

I am honored to greet you today representing the National Institute of Standards and Technology (NIST) and the Office of Weights and Measures. We consider ourselves the direct descendants of that Office of Weights and Measures established in 1836 as part of the U.S. Treasury. As you may recall, the objective of that Office was to construct a set of weights and measures (and balances to intercompare them) for each State and custom house "...to the end that a uniform standard of weights and measures may be established throughout the United States." As we all here know, this momentous work was begun by, and directly the result of intercomparisons made years earlier by Ferdinand Rudolph Hassler, when he was the Superintendent of the Coast Survey.

As stars were added to the United States flag from the 1840's, sets of standards and balances were constructed and presented to the new States until 1893, when a national depression precluded further presentations. However, in a very real way, his work continues to this day. His original program became the basis for what metamorphosed into the "new" State Standards Program. Begun in the 1960's under the then National Bureau of Standards, the State Standards Program of the Office of Weights and Measures is a very real partnership still vibrant today between NIST and the States. In return for providing a suitable laboratory environment and full-time metrologist, the National Bureau of Standards provided each State training for its metrologists, a set of mass, length, and volume standards, and instruments to compare the standards with unknowns. And Mr. Hassler's commitment is shared by a cadre of dedicated individuals and laboratories. Since the initiation of a new State Standards Program in 1966, States have gone on to add to their repertoire in liquid-in-glass thermometry, frequency, motor fuel quality, and moisture measurements. The program now encompasses continuing education at advanced levels of expertise, regional measurement metrology groups with industry, laboratory assessment, and accreditation. The State laboratories are an integral part of our legal metrology system, providing thousands more calibrations than NIST can provide, in 50 of a potential 55 accredited laboratories. Just as Mr. Hassler transferred the finest of European technology to our shores, we in the Office of Weights and Measures have been successful in transferring technology to the States, and the States in turn have been found to be an indispensable part of technological services to their businesses and industry.

I would like to introduce you to one of the direct descendants in spirit of Mr. Hassler, Ms. Georgia Harris, manager of the NIST Office of Weights and Measures State Standards Program. The State metrologists she guides and mentors are building quality into the measurement services they provide to industry and government by partnering with NIST, with private industry, and with each other.

As many of us have read, when the National Bureau of Standards (NBS) was founded in 1901, there was only an organizational name, a director, Samuel Wesley Stratton from the University of Chicago, and the Office of Weights and Measures (founded by Mr. Hassler). The Office of Weights and Measures and its director, Louis A. Fischer, were transferred from Treasury as the core unit of NBS. Thus, the National Bureau of Standards grew from the Office of Weights and Measures in much the same way as the National Institute of Standards and Technology is growing since 1988 from the National Bureau of Standards. Today NIST's Advanced Technology Program and its Manufacturing Technology Centers set the standards for our vital economy today. I hope Mr. Hassler is pleased with the progress his vision and perseverance began.

I believe the National Institute of Standards and Technology owes a debt of thanks to the "true-believer" in the power of good measurements. Thank you, Mr. Hassler, for your dedication and vision. God grant you your reward.

3.4 *Origin of "The Project"*, by Martha Coleman Bray, Author of *Joseph Nicollet and His Map*

At the time it seemed like the most natural thing in the world for Captain Charles Burroughs and ourselves, Martha and Ned Bray, to meet in 1985 at the Smithsonian Institution before the window of a display case featuring the instruments and an original portrait painting of Ferdinand Rudolph Hassler, the founder of what became the Coast and Geodetic Survey. We had a mutual interest in it. But looking back it seems almost something more than an extraordinary coincidence that, unknown to each other, we should be there at the same moment. The exhibit was honoring the United States Exploring Expedition, sometimes known as the Wilkes Expedition after its leader, Charles Wilkes, who had had a "rigorous training" under Hassler. It was a bold venture to send scientists out into the ocean world explored seven decades before by the great Captain Cook. This country then lacked well developed scientific institutions and among the men of international reputation only one name came immediately to mind, that of Swiss born Ferdinand Rudolph Hassler, with whose accomplishments Charles Burroughs was well acquainted, as are most of you who read this.

As to ourselves, we had become interested in mapmaking through the work of a much less well known French cartographer and astronomer, Joseph Nicollet. As a recent Minnesotan, I had discovered him through his great map of the triangle of land between the Mississippi and the Missouri Rivers which had been published by the U.S. Senate in 1843. I had edited, with Ned's assistance, two volumes of Nicollet's journals of his preparatory explorations of that little known area. My curiosity led to the writing of a biography, *Joseph Nicollet and His Map*.

As a penniless political refugee from France, Nicollet had come to the United States and looked up the only man with whose reputation he was familiar. Hassler assisted him in every way and the two became friends, carried on a lively correspondence, highly critical of the U. S. bureaucracy, and worked on Nicollet's map together in Washington. Entitled *The Hydrographical Map of the Region ...*, its accuracy made possible further mapping of the West and employed for the first time in this country the use of the barometer for the measurement of heights. This was of particular interest to Nicollet in describing the flow of rivers and streams. A later railroad survey found that his altitudes were correct to within fifty feet.

As we were looking at Hassler's instruments we discussed the artificial horizon in so knowledgeable a fashion as to intrigue Charles Burroughs, and we were soon talking together.

It had so happened that we were spending some early years of retirement in Philadelphia and were accustomed to spending a Sunday afternoon now and then in Laurel Hill Cemetery which has a fine view over the Schuylkill River, and which introduced us to a number of famous people. And there on the hilltop was the grave of Hassler much in need of attention. I pointed this out to the American Philosophical Society of which he had been a member and to a descendant who was at the Institute for Advanced Study at Princeton. I followed this up with a letter to NOAA which aroused the interest of the person who received it who wrote asking for more information. Then in the way of the government, this person was apparently transferred and there was no more interest expressed. We told our story to Captain Burroughs, and you know the rest.

We are grateful for the interest and pleasure of following this project and delighted with and proud of the result.

3.5 *Some Reflections on Hassler's Contributions to the Surveying and Mapping Sciences*, by Richard E. Dahlberg, President, American Congress on Surveying and Mapping

Introduction:

I feel highly honored to be present on this occasion and to represent the American Congress on Surveying and Mapping. As we honor the memory of this great leader we have an opportunity to remind our colleagues, and especially those colleagues just entering our professions, of the important contributions made by him in the first half of the nineteenth century.

Upon reviewing the chronology of Hassler's career, one is struck by the fortuity of his arrival in a very young nation and the actions of the Congress to initiate a survey of the east coast to support maritime activities. When he left Switzerland to come to the United States, he was a mature scientist who had had a wealth of experience in applying science to basic surveying and mapping tasks. He brought not only his experience, energy, and a proactive propensity, but also a large library and collection of instruments. Today we might classify him as a technology transfer agent par excellence who brought his own infrastructure.

Those of us in the surveying and mapping professions are thankful for his timely arrival and his many contributions to our fields. He had the vision and determination to initiate the creation of a robust spatial foundation for the new nation's information infrastructure. He contributed richly to the intellectual milieu of an emerging scientific community and brought vision and high standards to applied science in the public's service.

Polyconic Projection [See Fig. 1]:

The invention of the polyconic projection by Ferdinand R. Hassler in 1820 was an extraordinarily timely event in that it was available for use at the very beginning of the process of creating a new nation's geographic data base. It was an eminently practical solution to a prospective mapping task and its conception was a clear indicator of Hassler's pragmatism. It enjoyed widespread use, especially in the United States, for more than a century. Its decline in the decade of the 1950s was a harbinger of the Information Revolution which ushered in developments such as stable-based media, spatial data bases, and automated mapping technology that were to have profound impacts upon the surveying and mapping sciences.

The cartographic task that Hassler addressed was that of selecting or devising a projection suitable for representing a long and narrow coastal zone oriented in an inter-cardinal direction. The great length and northeast-southwest orientation of the coast ruled out the selection of a conventional projection or the representation of the area on a single projection zone. His solution was a graticule with a straight central meridian on which the intersections of the parallels are truly spaced. Thus, the scale is true along all parallels. The parallels are circular but non-concentric arcs, each representing a tangent circle from a unique cone. Hence the term polyconic.

The zone of best representation is a narrow north-south zone centered on the central meridian and within which distortion is extremely small. For quadrangle mapping at large scales, each individual sheet is centered on the central meridian of the projection. Although quadrangle graticules thus developed will fit together precisely in a north-south direction, they will not fit so precisely in an east-west direction because the marginal meridians in theory are slightly curved with their convex sides facing neighboring quadrangles. However, in practice, for quadrangle maps of the 7.5- or 15-minute series, the edge meridians are drawn as straight lines.

Thus, Hassler's concept of placing each map sheet at the center of its projection resulted in a graticule having extremely small distortions. In addition to possessing a high quality of projection geometry for a small area, the projection concept was easy to understand and the graticule was easy to construct. Early in its history, tables were published providing x and y coordinate values for grid intersections. The polyconic is considered a universal projection in that tables of rectangular coordinates may be used for any polyconic projection of the same ellipsoid.

The widespread use of the polyconic projection derives from its adoption in the 19th century by federal surveying and mapping agencies. It was used early on by the Coast and Geodetic Survey for coastal charts and by the Geological Survey for its topographic quadrangle maps for about 70 years. In the late 1950s, however, the Geological Survey discontinued its use of the polyconic in favor of conformal projections especially appropriate for the State Plane Coordinate Systems.

For military applications, a system of rectangular coordinates called the "Grid System for Progressive Maps of the United States" was established in 1918. It was devised by the Coast and Geodetic Survey and the Army Corps of Engineers. This grid system was based upon the polyconic projection and employed seven zones, each nine-degrees wide, to cover the United States. The rectangular coordinates were in yards. For U.S. possessions separate zones were established and later the system was extended as the World Polyconic Grid to cover all areas not covered by the British military grid. In 1947 these systems were superseded by the Universal Transverse Mercator grid system.

For use on the International Map of the World, a modified version of the polyconic was chosen. Maps of this series were published at a scale of 1:1,000,000, generally in 4- x 6-degree quadrangle formats. Devised by Lallemand, the modified polyconic projection was used from 1909 until it was replaced in 1962 by the Lambert conformal conic projection.

It was recognized by cartographers such as Charles H. Deetz, of the Coast and Geodetic Survey, that the zone of excellent representation of the polyconic, extensive in north-south and narrow in east-west directions, could be re-positioned from a central meridian to some other great circle by shifting the nest of cones in relation to the globe. He constructed a Transverse Polyconic Projection for a geographic map of the North Pacific Ocean (USCGS Chart No. 3080). The National Geographic Society also used the Transverse Polyconic Projection on its maps of "Asia and Adjacent Areas" (1942) and the "Union of Soviet Socialist Republics" (1944).

Summary:

Those of us in the surveying and mapping professions are today very much preoccupied by the concept of an evolving spatial data infrastructure. As we reflect upon Hassler's contributions within a spatial data infrastructure framework we recognize: his important role in establishing a robust geodetic control foundation for the infrastructure; his insistence upon definitions and standards; his international network within the scientific community; his mentoring of junior staff; and perhaps, most of all, his sense of vision.

Figure 1.

Source: Snyder and Voxland, 1989.

POLYCONIC Projection

Classifications
Polyconic
Neither conformal nor equal area

Graticule
Meridians: Central meridian is a straight line. All other meridians are complex curves, spaced equally along the Equator and along each parallel and concave toward the central meridian.
Parallels: Equator is a straight line, poles are points, and all other parallels are nonconcentric circular arcs spaced at true distances along the central meridian. Each parallel has a curvature identical to its curvature on a cone tangent at that latitude. Many cones are involved; hence, the name "Polyconic projection."
Symmetry: About the central meridian and the Equator

Scale
True along the central meridian and along each parallel

Distortion
Free of distortion only along the central meridian (fig. 43*A*). Extensive distortion if the range extends very far east or west.

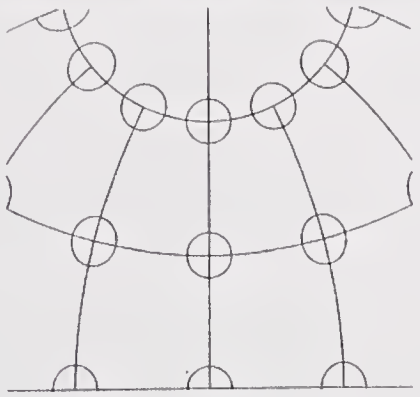
Usage
The sole projection used for large-scale mapping in the ellipsoidal form (topographic quadrangles) of the United States by the U.S. Geological Survey until the 1950's
Basis for Progressive Military Grid used by the U.S. Army until the 1940's
Projection for many early coastal charts by the U.S. Coast and Geodetic Survey
Not recommended for regional maps, because other projections are better

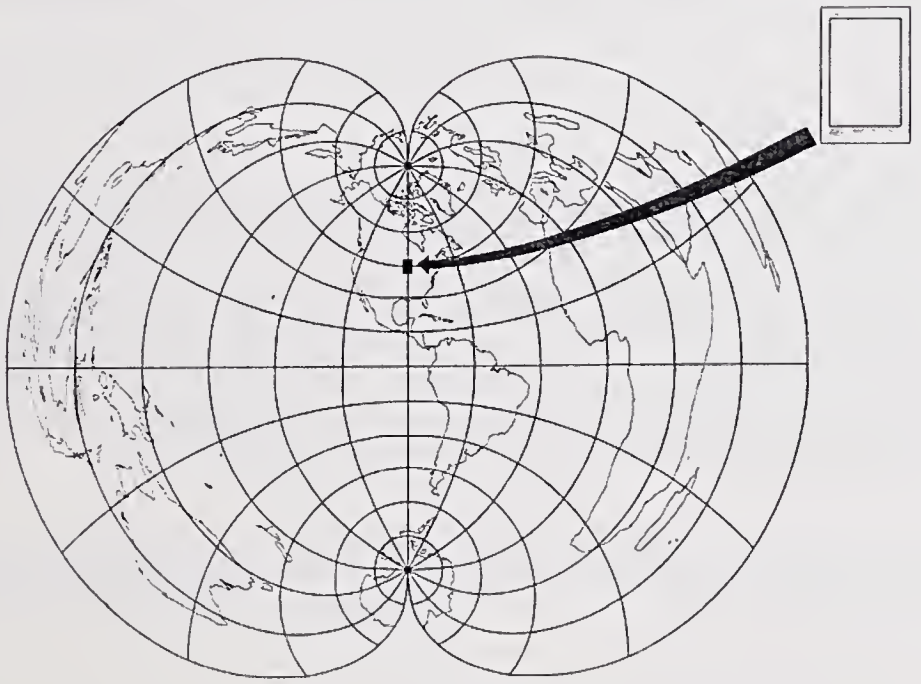
Origin
Apparently originated about 1820 by Ferdinand Rudolph Hassler (1770–1843), first director of the Survey of the Coast (later the U.S. Coast and Geodetic Survey)

Aspects
Transverse aspect (fig. 43*D*) was proposed by Charles H. Deetz of the U.S. Coast and Geodetic Survey in the early 20th century. The National Geographic Society has used the transverse aspect for maps of Eurasia and the Soviet Union.

Other names
American Polyconic
Ordinary Polyconic

Figure 43*A*.—Polyconic projection, with Tissot indicatrices, 30° graticule





References:

Adams, Oscar S. *General Theory of Polyconic Projections*. U.S. Coast and Geodetic Survey Special Publication 57. Washington, D.C.: Government Printing Office, 1934.

Birdseye, C. H. *Topographic Instructions of the United States Geological Survey*. U.S. Geological Survey Bulletin 778. Washington, D.C.: U.S. Government Printing Office, 1928.

Cajori, Florian. *The Chequered Career of Ferdinand Rudolph Hassler*. Boston: The Christopher Publishing House, 1929.

Chamberlain, Wellman. *The Round Earth on Flat Paper: Map Projections Used by Cartographers*. Washington D.C.: National Geographic Society, 1947.

Cochrane, Rexmond C. *Measures For Progress. A History of the National Bureau of Standards*. NBS Miscellaneous Publication 275. Washington, D. C.: National Bureau of Standards, 1966.

Deetz, Charles H. *Cartography: A Review and Guide,* Rev. ed. U.S. Coast and Geodetic Survey Special Publication 205. Washington, D.C.: U.S. Government Printing Office, 1943.

Deetz, Charles H., and Oscar S. Adams. *Elements of Map Projection,* 5th ed. U.S. Coast and Geodetic Survey Special Publication 68. Washington, D.C.: U.S. Government Printing Office, 1945.

Dupree, A. Hunter. *Science in the Federal Government: A History of Policies and Activities to 1940*. Cambridge, Mass.: Belknap Press & Harvard University Press, 1957.

Frazier, Arthur H. "The Monument for Ferdinand Rudolph Hassler at Laurel Hill Cemetery, Philadelphia." *ACSM Bulletin* (American Congress on Surveying and Mapping), no. 62 (August 1978): 15-17.

Schott, Charles A. "A Comparison of the Relative Value of the Polyconic Projection Used on the Coast and Geodetic Survey, With Some Other Projections." Appendix No. 15 in *Report of the Superintendent of the U.S. Coast and Geodetic Survey Showing the Progress of the Work During The Fiscal Year Ending With June, 1880*. Washington D.C.: Government Printing Office, 1882.

Snyder, John P. *Flattening the Earth: Two Thousand Years of Map Projections*. Chicago: University of Chicago Press, 1993.

———. *Map Projections Used by the U.S. Geological Survey*. U.S. Geological Survey Bulletin 1532, Washington, D.C.: U.S. Government Printing Office, 1982.

Snyder, John P., and Philip M. Voxland. *An Album of Map Projections*. U.S. Geological Survey Professional Paper 1453. Washington, D. C.: U.S. Government Printing Office, 1989.

Wraight, A. Joseph, and Elliott B. Roberts. *The Coast and Geodetic Survey 1807 - 1957: 150 Years of History*. Washington, D.C.: U.S. Government Printing Office, 1957.

3.6 *The Hassler Carriage*, by William A. Stanley, Historian, NOAA

We come here today to honor one of America's prominent scientific minds; a man of unique ability, fortitude and determination. Ferdinand Rudolph Hassler was a visionary whose attributes were recognized by men of science of the 19th century.

A native of Switzerland, Hassler's early years were spent in conducting trigonometric surveys of his home district of Aarau. In 1805 he came to the United States and began his pursuits with a teaching assignment at West Point. Later, he accepted a professorship in natural philosophy and mathematics at Union College, Schenectady, New York. Hassler was not an accomplished educator; rather he was consumed with thoughts of ways of improving land surveying techniques. He was not very successful in his attempts to convey his theories to his students. It was, however, while he was at Union College that he developed his unique and entirely new concept in surveying. The plan reflected a thorough grasp of the problems involved in field surveying. His approach demonstrated a uniquely advanced theory of the entire field of geodesy and gained him international recognition as his writings became known.

At about the time Hassler was engaged in his thoughts of surveying in 1806, the Ninth Congress of the United States recommended the establishment of a "survey of the coast" of the United States to include all regions of the coasts and the immediate adjacent topography. A bill was reported out of committee on January 6, 1807 and after several amendments it was approved by the Congress and sent on to President Jefferson who signed the legislation on February 10, 1807. The execution of the Act of 1807 was assigned to the Department of the Treasury. On March 25, 1807 a circular was issued by Secretary of the Treasury Albert Gallatin requesting men of science to submit plans for the survey.

With the full approval of the American Philosophical Society, Hassler's plan was accepted by the Treasury Department in June 1807. At the age of 46 he began the arduous task of surveying the coastal waters and adjacent land areas of the United States. His plan prescribed for the development of a series of triangulation stations along the coast by which all detailed surveying operations would be controlled for accuracy; with each separate unit fitting exactly into the overall scheme. Professor Hassler soon learned that dealing with the political atmosphere in Washington was as taxing as the field work. His first field surveys were conducted in 1816-17 near New York City. To accomplish the field tasks he designed several new and innovative surveying instruments. He also recognized the logistical problems of moving his equipment and personnel from one location to another. Before Hassler began the actual field work, he was convinced that some type of unique means of transporting his delicate instruments must be designed.

In a letter to the Treasury Department dated November 23, 1816, he notes that there was a need to purchase a carriage of the "Jersey Wagon" variety to be built with special modifications. In late 1816, he approached the Camfield Coach Builders of Newark, New Jersey to build a Jersey carriage of his own design and exact dimensions in order to accommodate the instruments, field notes, and other related field paraphernalia. Hassler's carriage was as unique as his plan for the surveys. The carriage was mounted upon two very large "C" springs with locations in the front and back for specially designed cases that would hold the instruments. The wheels were extra wide and its springs were mounted lower to the ground to reduce vibration. The carriage was almost square in shape with every inch of the interior sections carefully planned to maximize space. It had a folding top for protection against the elements.

Being a gentleman of European quality, Hassler included in the design a "spirit-room" to house his Swiss wine and a second compartment to store his cheese. The carriage seats were hinged to provide ease of access to the storage space beneath.

The carriage originally was drawn by two horses. The under side of the carriage had a large storage compartment where Hassler kept his field drawings, books and other small items. Two compartments were manufactured which accommodated both large and small instruments. The carriage was indeed the first "office" of the Survey of the Coast. The coach maker had insured that the delicate instruments would ride smoothly in their two compartments, which were held snugly against each other as the field party moved over the hilly terrain from station to station.

Hassler had the carriage painted mustard yellow to insure visibility from a distance when field work extended many miles from the base camp. In the evenings when the day's labor was completed, Professor Hassler would have the carriage's portable table positioned in the center of the floor. White linen was brought out to cover the unfinished wood top. He would then retrieve his wine and cheese and reflect on the days activities. The table top and base would then be removed and stored. The vehicle would serve as his sleeping quarters at night. As he traveled through the country-side of the northeast, what an interesting sight it must have been for the local population to see this gentleman in his yellow carriage, wearing his brown suit and long coat; constructing the strange looking monuments and devices as he went about the business of preparing the surveys.

In the fall of 1817, after only 5 months in the field, the politics of Washington reared its ugly head and Hassler was dismissed. All operations were suspended. In 1819, Hassler bought the carriage along with the two horses at a government auction. He then used the carriage to move his belongings to Jefferson County, New York where it was stored in a barn until the Survey resumed work. For about 15 years he tried his hand at several occupations including farming in Jefferson County before being reappointed to his former position as head of the Survey of the Coast in 1832. At the age of 62, Hassler finally began his work in earnest. He took the carriage to the Camfield carriage maker and had it repaired and repainted at a cost of $500. Now outfitted with four horses, Professor Hassler was ready to complete his survey work.

In 1836, the agency changed its name to the U. S. Coast Survey. From 1836 until his death on November 20, 1843, Hassler completed the surveys from Rhode Island into Delaware. The first published chart was issued in 1839 of Newark Bay, New Jersey, followed by charts of New York Harbor, Annapolis Harbor and other ports to the south.

We have seen one individual's vision and determination take this nation's task of describing and defining our coastal waterways to such a level of accuracy that modern nautical charts laid over a chart of a century ago show a remarkable similarity in detail and accuracy. Hassler can indeed be called our government's first surveyor.

Editor's note: For a picture of Hassler's carriage, see p. 93.

4. Hassler Memorial Park Dedication, NOAA Headquarters, Silver Spring, Maryland, November 15, 1995

4.1 Overview

Hassler Park was created outside of NOAA headquarters as part of the final phase of landscaping the new facility in downtown Silver Spring. It was financed by NOAA and the U.S. Coast and Geodetic Survey Society. The Park features, at one end, three bronze plaques. The center plaque describes Hassler's work and traces the organizational lineage from Hassler to NOAA. It includes a bronze bas relief portrait which was cast from a mold made from the original tablet from the Hassler Memorial Monument. At the other side of the park, a geodetic survey marker designates Hassler Station, part of a national network of geodetic survey positions.

The park was dedicated in 1995 with a ceremony at the NOAA Science Center just down the street from the park. William A. Stanley, NOAA Historian Emeritus, who had played a critical role in the creation of the park, led the program. Guests included Diana Josephson, Deputy Under Secretary of Commerce, and Raymond Kammer, Deputy Director of NIST. The three presentations included here concluded the event.

At left, Hassler Memorial Park, NOAA Headquarters, Silver Spring. At right, U.S. Coast and Geodetic Survey triangulation station disk stamped "HASSLER 1993" on top of the granite monument in the foreground on the other picture. (Photographs: NOAA)

4.2 *Remarks*, by Rear Admiral Harley Nygren, NOAA (Ret.); Coast and Geodetic Survey Society

The Coast & Geodetic Survey Society is pleased that this afternoon is the culmination of many years of effort which have led to the dedication of this memorial to F.R. Hassler. A number of individuals have contributed substantially to this, including past and present officers and board members of the Society, notably Charlie Burroughs and Bill Stanley.

It has been asked why the Society, or any Society, would be interested in memorializing a man who has been dead for over a century. Those of us interested in history would respond that the study of it is not only entertaining, but that we can learn something from it as well. After all, history was not invented in the 1960's. Take, for instance, a few highlights of the life of F.R. Hassler.

In 1807 he was a foreigner, who won the bid for the Survey of The Coast against a slate of accomplished alternates. He got the job on merit. By that time his reputation was firmly established. People were either for or against him. Although the Survey was authorized in 1807, no funds were appropriated, and he had to make his living as a professor. In 1811 the dollars finally showed up, and he went to Europe to procure instruments and supplies. Trapped by the War of 1812 he did not return until 1815, with his appropriation over expended. I understand that he had to personally buy his return ticket.

He started field work in 1816. His biography states, “His letters and reports indicate a lack of cooperation by some government officials, who probably lacked appreciation for the complexity of the task." In 1818 the project was transferred to the Navy, minus Hassler, who turned to farming in order to survive. In 1830, he was appointed Superintendent of The Office of Weights and Measures. In 1832 the Survey came back to The Treasury Department and Hassler was restored to office as Superintendent. In 1834, once again, the project went to the Navy, this time with Hassler in charge. In 1836, following his objections, it returned to Treasury.

Hassler died in 1843, after being injured and suffering from exposure while engaged in field surveys. He was 73 years old. His biography states, "Hassler's sincerity and integrity won political and public acclaim in the end." His organizations continued long after his death, and survive in modified form today. In fact, the Central Radio Propagation Laboratory of the National Bureau of Standards was transferred in 1965 to join the Coast and Geodetic Survey and the U.S. Weather Bureau to form the Environmental Science Services Administration, thus forming the genesis of the Boulder Laboratories of the National Oceanic and Atmospheric Administration.

Hassler had problems with funding, with political interference, with patronage, and with the physical environment. He personally gained little but acclaim. The problems he faced also continued, right up to today.

4.3 *Remarks*, by Dr. Hans Oser, President, Standards Alumni Association

Ferdinand Rudolph Hassler was born on October 7, 1770 in Aarau, the capital of the Swiss Canton Aargau (probably the flattest of all the Swiss Cantons). The town is only 37 km from Basel whose University was founded way back in 1460 by Pope Pius II (who had been in town for the Council of Basel). Hassler was born into a wealthy family (his father was a watch maker) and he received a first-rate education in mathematics, astronomy and geodesy at the institute that was later to become the University of Bern. His teacher, Johann Georg Tralles, took part in the determination of the meter in 1798 by request of Talleyrand. Tralles and Hassler together provided geodetic mapping of the Canton Bern with the support of the town fathers. Tralles was later made an honorary citizen of Switzerland for his services.

After Tralles left Bern, Hassler became a local official in Aarau. He got married in 1798. His peace was disturbed, however, by the violent events of the Napoleonic wars and he decided to immigrate to the United States. His plan to establish a Swiss colony in South Carolina, or possibly Louisiana, fell through because of the dishonesty of an associate who had speculated with the funds entrusted to him.

After his arrival in Philadelphia in 1805, then the Capital of the United States, Hassler was welcomed by his compatriot Albert Gallatin, then the Secretary of the Treasury. He saw himself forced into selling a substantial part of his library in order to make ends meet. Gallatin introduced him to President Thomas Jefferson, an acquaintance that later led to his appointment as Superintendent of the Survey of the Coast in 1816 with a salary of $3,000, plus $2,000 for expenses, a year.

Before that occurred, however, economic necessity required him to produce income to support his family, and he accepted a position as acting professor of mathematics at West Point until 1810, when he moved to Union College at Schenectady to teach natural philosophy and mathematics. He taught geodesy, analytical geometry, and descriptive geometry (i.e., graphic constructions of complex geometric shapes, using projections). He used Legendre's *Geometry* as his textbook, we are told.

Let me depart from Hassler now and talk a little bit about Swiss tradition in mathematics, and geometry in particular. From a fractal mathematician's point of view, there are few countries that can beat the dimensionality of the Swiss terrain with its many jagged alpine peaks and valleys. Surveying such complex terrain posed challenges hardly found elsewhere on the European continent. Geometry, both the analytic and descriptive kind, was therefore a challenge to the teachers of mathematics early on. For example, Jacob Steiner (1796-1863), born in Bern, can be seen as the founder of synthetic geometry (the type that relies on construction by compass and straight edge alone). I found a more remarkable connection to geometry right in the city of Aarau, where the young Albert Einstein, after failing to pass the entrance exam to the Eidgenössische Technische Hochschule in Zürich in 1896, had to make up for his deficiencies in formal learning. He spent a year in Aarau, where he obtained his high-school diploma under the tutelage of a first-rate mathematics teacher who taught him the elements of differential geometry that later were to become the foundation of Einstein's general theory of relativity. (As an aside, Einstein's sister, Maja, later married that math teacher and raised a large family in Zürich).

I want to conclude with a brief summary of what we have heard today: Hassler was the child of a prosperous Swiss businessman who provided his son with a solid education and a comfortable endowment. His ability to travel to America with the aim of founding a Swiss colony by chartering a 350-ton ship, loading it with 96 trunks, 120 laborers, artisans, and craftsmen, and his family of six, shows the level of his accomplishments early in life (and his father's deep pockets he could rely on). The shattering of his dream through the carelessness of his partner who had speculated away most of his fortune would have devastated lesser men. His broad education included law and political science, mathematics, chemistry, mineralogy, and all other branches of natural philosophy. On top of that, he had gained practical experience in geodesy in his surveys with Tralles of the Canton Bern and he was well-versed in astronomy. Hassler's broad educational background made it possible to accept the commission from the federal government to "take a survey of the coasts of the United States," even though it took the U.S. Congress years to provide the funding for the task.

In dedicating this park today, we are celebrating Ferdinand Rudolph Hassler, a pioneer who, like so many of his time, came to these United States with a plan for a new life, ended up quite differently from what he had planned, and in the process, became spectacularly successful.

4.4 *Remarks*, by Captain Charles A. Burroughs, NOAA (Ret.)

Good afternoon, ladies and gentlemen. It is not my intent to deliver a speech as the concluding presenter on today's program. Rather, I would like to take this opportunity to recognize certain organizations and individuals who have made this historic occasion possible. On the other hand, I would also like to close with a few observations about our friend, Professor Hassler, and a few of the people's lives he affected by his own life and great works.

First, I would like to recognize the U.S. Coast & Geodetic Survey Society for the support they have provided over recent years toward not only this event but the one that preceded it in Philadelphia two years ago. I refer to the restoration/renovation of the Hassler Memorial Monument at Laurel Hill Cemetery. Many of you in this room personally contributed to that accomplishment and were there that mid-September day in 1993 during its unveiling and re-dedication. I have with me a number of pictures from that event and would be pleased to share them with you during our time together during the reception that follows. Also, I have prepared as a handout, the inscription that appears on the memorial tablet that is an integral part of the Memorial Monument. On the original tablet, the lettering had become nearly illegible, especially toward the bottom, and that was why it was decided to prepare a recut tablet. That inscription alone captures the essence of the man we are memorializing on this occasion. The original tablet now resides with our good friends at NIST (formerly the National Bureau of Standards) at Gaithersburg to some day serve as the basis of a special reminder of our common heritage at that location. And what pleases me most about the present Hassler Memorial Park we are here to dedicate today is the fact that the bas relief of Hassler's portrait that is mounted as a centerpiece of the park was cast from a mold made of the bas relief on the original tablet. That mold was made by Harvard C. Wood, Sr., of Wood Memorial Works who is in the audience today.

Getting back to the U.S. Coast and Geodetic Survey Society, I would especially like to recognize the chairman of our small committee, Bill Stanley, who has masterfully rallied the support of many of its members to perform the various tasks required to organize today's event. Foremost amongst this group, in addition to Bill's untiring work, was that of the Society's treasurer, Pete Kennedy, who saw that the invitations and programs were properly laid out and printed and made available to all of us here today. I might add that Pete is also the one who edits, prepares and mails the Society's newsletter, *The Buzzard*. I hope many of you will corner Pete during the reception and extend your own personal thanks for his efforts. I should also mention that Dr. Ferdinand Hassler was also an important player in this whole effort (and that in Philadelphia as well) representing the family's interest. And I am sure Bill will mention others on the committee who played important roles.

Now, for the last person in the audience who I would like to especially recognize, I'm going to do this in a rather round-about way. First, I would like to show a rather special map and make mention of several individuals whose names appear in the title block and whose lives were very much impacted one way or another by Professor Hassler. The date that appears on this map is 1843, the very year of Hassler's death. I realize it must be difficult for you to see but I guess it should be rather obvious with Lake Superior appearing in the upper right-hand comer that it is nowhere near the ocean with all these drainage patterns depicted. The title reads: "Hydrographical Basin of the Upper Mississippi River From Astronomical and Barometrical Observations Surveys and Information" So who made this map? It was none other than one Joseph N. Nicollet who made the field observations during the years 1836 through 1840 with the assistance of Lieutenant John C. Fremont for the last three of those five years. What does this all have to do with our Professor Hassler? As it turns out, Nicollet, a trained Parisian astronomer, became a French exile who befriended the already Americanized Hassler in the early 1830's, just about the time the Coast Survey was being resurrected by a reluctant Congress. To make a long story short (and the details are in this book: *Joseph Nicollet and His Map*, the author of which I will soon introduce), Hassler had a great influence on both Nicollet and his young protégé, John C. Fremont. In fact, most of the work on the construction of this map was performed by Fremont on the dining-room table in Hassler's home on Capitol Hill! As a further aside, and providing another interesting twist to this story, is the role Hassler played in being a "matchmaker" for the 28-year-old Lieutenant Fremont in 1841 as he was courting 16-year-old Jessie Benton, daughter of Senator

Thomas Hart Benton from the State of Missouri. To read about how that story played out, I recommend Irving Stone's classic biography of 1964 about Jessie Benton and how she supported her husband's career, titled *Immortal Wife*.

But getting back to Nicollet and his map, it was the author of the earlier book mentioned, Martha Coleman Bray, who I would now like to introduce. If it weren't for the chance meeting of Martha and I at the opening of a major exhibition at Smithsonian's Natural History Museum in the year of my retirement from NOAA ten years ago, we might not be here today. At this point, I would like to quote from Martha's address at the 1993 Hassler Memorial Monument renovation ceremony:

> "The exhibit was honoring the United States Exploring Expedition, sometimes known as the Wilkes Expedition after its leader, Charles Wilkes who had a 'rigorous training' under Hassler."

(Here we see yet another whose life was influenced by Hassler). Martha goes on:

> "As we were looking at Hassler's surveying instruments we discussed the artificial horizon in so knowledgeable a fashion as to intrigue Captain Burroughs, and we were soon talking together. It had so happened that we were spending some early years of retirement in Philadelphia and were accustomed to spend a Sunday afternoon now and then in Laurel Hill Cemetery which has a fine view over the Schuylkill River and which introduced us to a number of famous people. And there on the hilltop was the grave of Hassler much in need of attention. I pointed this out to the American Philosophical Society, of which he had been a member, and to a descendant who was at the Institute for Advanced Study at Princeton. I followed this up with a letter to NOAA which aroused the interest of the person who received it who wrote asking for more information. Then in the way of the government, this person was apparently transferred and there was no more interest expressed. We told our story to Captain Burroughs, and you know the rest."

There's more, but I will leave it at that. So, thank you, Martha, and thank you all for coming out today.

Monument Inscription:

IN MEMORY OF
FERDINAND RUDOLPH HASSLER
BORN AT AARAU IN THE CANTON OF ARGOVIE, SWITZERLAND
OCT. 6, 1770.
HAVING FILLED WITH HONOR BOTH IN HIS NATIVE & ADOPTED COUNTRY
OFFICES OF HIGH TRUST AND RESPONSIBILITY.
DIED IN PHILADELPHIA NOV. 20, 1843.
IN THE MIDST OF HIS LABORS AS SUPERINTENDENT OF
THE UNITED STATES COAST SURVEY
AND
STANDARDS OF WEIGHTS & MEASURES
BOTH GREAT NATIONAL WORKS FROM THEIR ORIGIN ENTRUSTED TO
AND CONDUCTED BY HIM WITH DISTINGUISED REPUTATION & SUCCESS.
STRICT INTEGRITY AND LOVE OF TRUTH, WITH STRENGH
AND ACTIVITY OF INTELLECT, CHARACTERIZED HIM AS A MAN,
WHILST HIS VARIOUS SCIENTIFIC WRITINGS AS WELL AS
THE TWO NATIONAL WORKS PROJECTED BY HIM ARE ALIKE
MEMORIAL OF HIS LABORIOUS LIFE AND OF HIS CONTRIBUTION
AS A MAN OF SCIENCE TO THE INSTRUCTION AND IMPROVEMENT
OF HIS FELLOW MEN.

5. Hassler Memorial Tablet Dedication, NIST, Gaithersburg, Maryland, December 2, 2004

5.1 Overview

On December 2, 2004, NIST held a ceremony to dedicate a new exhibit in the NIST Administration Building Lobby, the Ferdinand R. Hassler Memorial Tablet. The tablet, containing a portrait relief and elegiac text, is the same one originally erected at Laurel Hill Cemetery in Philadelphia in the late 1840s. When the monument in Philadelphia was renovated in 1993 (see Section 3), this original stone went for safe-keeping to NOAA in Silver Spring, Maryland. It was later given to NIST to be exhibited in a place of honor. This section contains the complete remarks given at the ceremony, which relate the stone's full life story, from its original creation, subsequent deterioration, later replacement, and recent rejuvenation at NIST. Presentations from the Hassler family fill out the story of Hassler's own life and continue his story into the next generations. Also included is an article about the event which appeared in the *ACSM Bulletin*, a publication of the American Congress on Surveying and Mapping.

The Hassler Memorial Tablet as installed in the lobby of NIST Administration Building. (Photographs: NIST Information Services Division)

5.2 *Remarks*, by Dr. Albert C. Parr, Chair, NIST Museum Committee; Division Chief, NIST Optical Technology Division

NIST did not spontaneously emerge from the Maryland countryside but instead these buildings and the research efforts they contain represent the combined efforts of generations of scientists and engineers. It is important that, from time to time, we reflect upon the history of our institution in order to better understand and appreciate the context of our present endeavors with respect to the economy and its priorities. In this regard, this stone reminds us of the seminal contributions of Ferdinand Rudolph Hassler in initiating activities in weight and measurement standards work in the United States that form the basis of the present NIST mission.

The authors of the U.S. Constitution recognized the need for a system of standard weights and measures. In Article 1 Section 8, the founders directed Congress, "to coin Money, regulate the Value thereof, and of foreign Coin, and fix the Standard of Weights and Measures". The early American economy rested strongly upon trade with Europe and the finances of the early Federal Government relied strongly upon income from duties and fees on exported and imported items. The Income Tax did not start until the early 20th century. Thus it was essential that there was agreement in weights and measures in all the customhouses in the various ports to ensure uniformity and fairness and to enable the young government to fund its obligations. In addition, it was necessary to ensure that the weight and volumes of goods being imported were as described and it was therefore important that the weights and measures in the new Republic coincided with those in Europe. While much has changed in American life since Hassler's early efforts, similar economic driving forces serve as the impetus and justification for the present support of NIST by Congress and the public.

Fortunately for the newly formed United States, Ferdinand Hassler had immigrated to the new world in the late summer of 1805 with his family and a number of other Swiss emigrants who were seeking to start a new life and escape the conflicts that were plaguing Europe at the time. Hassler was a trained scientist and was expert in surveying and astronomy and was an accomplished mathematician. He had extensive travels in Europe prior to his immigration to the United States and was known to a number of prominent European scientists and scholars. He was a surveyor in Switzerland and held other important offices. When he immigrated to the United States he brought a large scientific library and a number of high quality surveying instruments and standards of mass, length and volume that were accurate replicas of those being used in Europe at the time.

Hassler experienced a number of difficulties after his arrival in the United States but nonetheless he introduced himself to important people and early scientists. He was known to Thomas Jefferson, himself a person of considerable scientific accomplishment, and other politicians and important people in the new government. As a result of his scientific knowledge and possession of surveying and other instruments he was commissioned by Congress to undertake a variety of tasks in surveying from 1806 to his death in 1843. Due to antagonism by some members of Congress and other conflicts, Hassler's surveying efforts suffered considerable difficulty and cost him a great deal from his personal resources and impacted his family considerably.

In 1830, President Jackson appointed Hassler in charge of the weights and measures in the new Republic and asked Congress to award him a stipend of $3000 per year for his work. Thus Hassler set about enlarging his collection of weights and standards and making replicas for use in the various customhouses and elsewhere as required in each of the states. Hassler continued this work until his death and, as appropriate, reported his accomplishments to Congress through the Secretary of the Treasury.

The stone we have placed in the NIST lobby was first placed as a part of the Hassler Memorial Monument in the Laurel Hill Cemetery at Philadelphia, Pennsylvania in the late 1840s. It was paid for and erected by the officers of the Army and Navy who had served with Hassler in the Coast Survey. It is a testament to Hassler's contributions and leadership that those who served with him saw fit to commission this memorial stone out of their own resources. This original stone was replaced in 1993 with a new memorial stone that is similar to the original. This was accomplished by the efforts of private donors with knowledge of Hassler's contributions to the country and with the support of the Hassler family. This stone was donated to NIST by the Hassler family and has been in storage until now. The NIST Museum Committee felt that a permanent exhibit of this stone, a testament by those who worked with Hassler, would be an appropriate reminder to all of us concerning the historical importance to the Nation of high quality metrology and the pioneering work by Ferdinand Hassler. We thank Director Bement for his support of this project and to Deputy Director, and Acting Director, Semerjian for his help in ensuring that we were able to complete the project. We believe that this stone and what it represents amplifies the importance of and adds perspective to the display on the left that describes the founding of the Bureau of Standards by Congress in 1901.

5.3 *Remarks*, by Dr. Hratch Semerjian, Acting Director, NIST

It's a pleasure to participate in this dedication.

I welcome Captain Roger Parson and Captain Charles Burroughs of NOAA. In a very real sense, Ferdinand Rudolph Hassler was, as first Superintendent of the Coastal Survey and as first Superintendent of Weights and Measures, the founder of both NIST and NOAA. I am delighted that we are finally acting on Dr. Stratton's almost century-old recommendation to commemorate Professor Hassler's vital contributions.

I also welcome Dr. Ferdinand Rudolph Hassler, V (the fifth), Ms. Ardoth Hassler, and, our own NIST colleague, Harriet Hassler. Each is a representative of the distinguished Hassler family. Each is a descendent faithful to the memory of a great forebear. And each has been a selfless contributor to NIST efforts to preserve his legacy for future generations. Thank you for all that you have done. Your participation makes this tribute all the more meaningful.

The man we honor today is far more than an historical figure. J.H. Alexander, Hassler's Maryland colleague on the coastal survey, eulogized his friend as, "patient, fearless, and industrious." Hassler, Alexander declared, was "essentially a man of truth … In his character he united everything which may be called great and good." NIST's first director Dr. Samuel Stratton called Hassler a "remarkable man … not only the first and foremost man in the scientific work of our country at that time but one of the leading, if not the leading, metrologists of his day."

Yes, Hassler was a great human being and a great scientist and a great patriot. Army and Naval Officers, who served with Hassler in his Coastal Survey days, perhaps said it best. They left a parchment on Hassler's coffin that said, "His scientific writings and the national works created by him for the United States serve not only as beautiful memorials of his active life but for the education and enlightenment of mankind."

Today Hassler's contributions to science and technology live on in the National Institute of Standards and Technology, the successor to Hassler's Office of Weights and Measures. Our mandate today is a bit larger than the one Presidents Jefferson, Jackson and Tyler gave Hassler. Still, NIST's mission to develop and promote measurements, standards and technology to enhance productivity, facilitate trade and improve the quality of life of Americans stems from his pioneering work.

Times have changed. Science and engineering have made tremendous advances. Certainly, Ferdinand Hassler would be stunned by 21st Century technology. Yet, I think that Professor Hassler, who has been called the Federal Government's first professional scientist, would recognize and be proud of our research methods and services. NIST's reputation for delivering concepts, tools, and results for precision measurements is unmatched in the world. Across the spectrum from applied to basic measurement science, our work—and our scientists—have earned international acclaim.

That's not surprising-- in Hassler, we learned from the best!

Ferdinand Hassler showed us the importance of building the best possible research instruments. The Building and Fire Research Laboratory's Integrating Sphere, the Electronic Electrical Engineering Laboratory's single electron transistors, the Manufacturing Engineering Laboratory's Molecular Measuring Machine – our new entire Advanced Measurement Laboratory – all prove that we have not forgotten that important lesson from the first Superintendent of Weights and Measures.

NIST is expected to do the job right the first time – whether we are talking nanotechnology, biometrics, optics or robotics research, investigation of the World Trade Center collapse or working on voting and homeland security standards. This, too, is part of Hassler's legacy.

I like to say "NIST enables the innovation infrastructure." Well, in 1832, Ferdinand Rudolph Hassler created standards for length, mass and capacity for the Treasury Department. Four years later the Congress ordered Hassler's standards to be sent to the governors of every state in the Union to establish uniform weights and measures throughout the nation. That was an essential first step in building this vitally important technology platform. Without this infrastructure the United States would not have become the world's most innovative nation.

This is a great day. As scientists and engineers, public servants and Americans we all owe an immeasurable debt of gratitude to Ferdinand Hassler. I am so happy that we can do so today.

5.4 *Remarks*, by Captain Roger L. Parsons, Director, Office of the Coast Survey, NOAA

Good afternoon. On behalf of Vice Admiral Conrad Lautenbacher, NOAA Administrator; Dr. Richard Spinrad, Assistant Administrator for the National Ocean Service; and Rear Admiral Sam DeBow, Director, NOAA Corps, it is my pleasure to represent NOAA at today's dedication of the Ferdinand Rudolph Hassler Memorial Tablet.

We are assembled today to honor the legacy of Ferdinand Rudolph Hassler, founder and first Superintendent of both the United States Survey of the Coast and the Office of Weights and Measures within the Coast Survey. Since its establishment in 1807, the Survey of the Coast has evolved into what is today the National Oceanic and Atmospheric Administration (which includes the Office of Coast Survey and the National Geodetic Survey), and the Office of Weights and Measures has grown to become the National Institute of Standards and Technology.

It is appropriate that we remember Ferdinand Hassler not only for his work as a scientist - the first science administrator within the United States Federal Government – but also as a great citizen of our Nation. He was a visionary who came to this young Nation from his native Switzerland with a view towards conducting a geodetic survey of our continent, producing detailed maps of the coast and interior and charts for mariners, and establishing standards of measurement for commerce and science.

This vision brought him to the attention of Presidents, the embryonic American science community, and much of early Nineteenth Century American society.

Every Government scientist today owes a debt of gratitude to Ferdinand Hassler. He established the United States Coast Survey, America's first science agency and the model for virtually every Government science agency since. He took a youthful United States science establishment from the era of individual naturalists to the era of organized science. The modern method of American science, consisting of teams of individuals, each working in their area of specialization to produce an end product, was brought to the United States by Mr. Hassler.

Ferdinand Hassler, besides being the first Federal scientist and founder of the Coast Survey, was also a pioneer in attempting to reform the civil service. He stood up against the spoils system during the administration of President Andrew Jackson and set the stage for merit hiring, merit promotion, and retaining the most qualified individuals for the work of the Coast Survey and the Office of Weights and Measures.

He fought the first political battles involving science in a young nation. The battles he fought concerning the roles of military and civilian science, governmental personnel versus contract personnel, and quality versus cost in scientific research and results are still providing challenges to us today.

He was the first in our Nation to fight for societal respect for the scientist and for a fair wage for scientists and engineers in the Government. He was not only a visionary in the realm of science, but also a firm believer in democracy and the necessity of having a strong, professional civil service to maintain vibrant democratic institutions.

Hassler was an example to those suffering from prejudice. He was attacked for his mode of speech, for his scientific ideals, and even for the way he dressed. Through all of this he prevailed - he built the foundation of a lasting Federal science organization.

As a measure of the respect that Ferdinand Hassler commanded, upon his death in 1843, his body was taken to the American Philosophical Society where he lay in state for final viewing. His body was then moved to Laurel Hill Cemetery in Philadelphia where he was buried. Officers of the Army and Navy who had served with him in the Coast Survey erected a Memorial Tablet at his grave site with an inscription which reads in part:

> STRICT INTEGRITY AND LOVE OF TRUTH, WITH STRENGTH AND ACTIVITY OF INTELLECT, CHARACTERIZED HIM AS A MAN, WHILST HIS VARIOUS SCIENTIFIC WRITINGS AS WELL AS THE TWO NATIONAL WORKS PROJECTED BY HIM ARE ALIKE MEMORIAL OF HIS LABORIOUS LIFE AND OF HIS CONTRIBUTION AS A MAN OF SCIENCE TO THE INSTRUCTION AND IMPROVEMENT OF HIS FELLOW MEN.

Doctor S. W. Stratton, first Director of the United States Bureau of Standards, after it became a separate institution from the Coast and Geodetic Survey, remarked at the Centennial Celebration of the Coast Survey in 1916, "Mr. Hassler was, indeed, a remarkable man. I consider that he was the first and foremost man in the scientific work of our country at that time ... I doubt if there were more than half a dozen people in the world ... who possessed the scientific knowledge and the deftness of the artisan necessary to undertake this work."

In the long run, Hassler's view that unswerving devotion to the principles of accuracy, precision, and scientific integrity are the best route for science have been proven right time and again. These principles now pervade American science. He gave a lasting gift not only to the Coast Survey and its related organizations, but to American science as a whole.

5.5 *Remarks*, by Captain Charles A. Burroughs, NOAA (Ret.)

Captain Burroughs' remarks delivered at the ceremony were later published together with the article "In Pursuit of Exactitude" by Ilse Genovese (see p. 111). Reprinted with permission from: *ACSM Bulletin* (American Congress of Surveying and Mapping), no. 216 (July/August 2005): 27-28.

This document begins on the following page.

Remarks

by

Capt. Charles A. Burroughs
NOAA Corps, Retired

In one sense, it is rather logical that the man who arrived in this country in 1805 from his native land of Switzerland is honored at this place in that he brought with him to the port of Philadelphia one of the earliest of meter bar measures known as the Committee Meter of 1799. This was used as the standard for length measure by the Coast Survey from 1816 to 1893, when it was superseded by an even more accurate meter bar measure constructed of materials less sensitive to temperature change. When the Office of Weights and Measures was transferred out of the U.S. Coast and Geodetic Survey, as it was known in 1901, at the time of the formation of the National Bureau of Standards, the Committee Meter was transferred with it and has been on exhibit in the Standards Museum ever since.

As to the Ferdinand Hassler Memorial Tablet, and how it came to be that it now occupies a prominent place in the Lobby of the NIST Administration Building, we have to go decades back in time.

It was a cold November evening in 1985 and I was at Smithsonian's Museum of Natural History at the opening of an exhibition commemorating Charles Wilkes' round-the-world exploration expedition of 1838 to 1842. The year 1985 was also the year I retired from 27 years' service with the Commissioned Corps of NOAA. Previously I had been asked to contribute to the chapter titled "Surveying and Charting the Pacific Basin" in the exhibition catalogue, essentially a stand-alone book about the expedition. So my station during the exhibition opening was in the Hall of Charts where there were also several large cases displaying various scientific instruments used on the expedition, as well as a large portrait of the man we are honoring here today.

An elderly couple who had come by train from Philadelphia approached me with a question about a particular instrument in one of the cases. Before long, the conversation came around to the portrait of Hassler who had served as a mentor for Wilkes, guiding him in certain specialized surveying procedures. They then informed me about a monument to Hassler at the Laurel Hill Cemetery, overlooking the Schuylkill River, which was literally, in their words, "falling apart."

Martha Bray, one of the Philadelphians I talked to at the Museum, had recently published a book about another of Hassler's contemporaries, Joseph Nicollet. The book—Joseph Nicollet and His Map—is based upon Nicollet's expeditions of 1836 to 1839 to map the headwaters of the Mississippi River. Nicollet's map encompassed the many streams that fed into the Mississippi from as far west as the Missouri River in today's South Dakota and eastward to the St. Croix River along the western border of today's Wisconsin. There are many linkages in the map's story that relate to Hassler at a later period in his life, but these must await telling at another time.

Martha was concerned about the condition of Hassler's monument in Philadelphia. She related how she had tried to get an "Act of Congress" passed to make the improvements that were necessary. But perhaps the ghost of Hassler had interceded, given his

unpleasant relations with that body during his lifetime, as nothing ever came of it. Then she attempted to communicate directly with the National Oceanic and Atmospheric Administration (NOAA). "They seemed interested," she said but with the many reorganizations going on at that time, nothing came of that either. It was as if I were being admonished on the spot, having recently retired from NOAA, to take up her cause. I did, and so it all started.

I took a trip to Laurel Hill Cemetery on the outskirts of Philadelphia some months later and found that the urn had broken off the top and the Memorial Tablet had eroded to the point of being almost unreadable, especially toward the bottom. With the initial backing of the U.S. Coast and Geodetic Survey Society, an alumni group formed in 1978, and that of the officers of the NOAA Corps, a fund-raising campaign commenced in 1986 that continued on and off over a period of five or six years. Early on, the Standards Alumni Association also became involved, along with several other organizations. I would especially like to recognize the American Congress on Surveying and Mapping as the organization that came in with the single largest contribution. All told, there were nearly 150 private donors in addition to at least half a dozen organizational and corporate donors that brought the fund up to a workable level.

The Hassler family became involved in this effort too. When one wants to find out something about a particular monument in a cemetery, one of the first places to look is in what is known as the "Plot File" at the cemetery office. In so doing, I came across a business card of a fairly recent vintage, inscribed Dr. Ferdinand R. Hassler, M.D., USPHS. I could hardly believe my eyes! When I called the number shown on the card, I learned that he had recently retired from the Public Health Service and lived in Kensington, Maryland. Our association has continued to this day.

We began by investigating how best to accomplish the restoration of the Hassler tablet, including whether to mount a metallic plaque directly on the massive stone monument. By 1992, we had decided to replicate the original marble tablet with a new-cut stone and, using the recommendation of the Monument Works, contracted for the work, we chose slate for this purpose. As you view the Memorial Tablet after this program, you will see pictures of the monument as it appeared in 1929 and after its restoration in 1993.

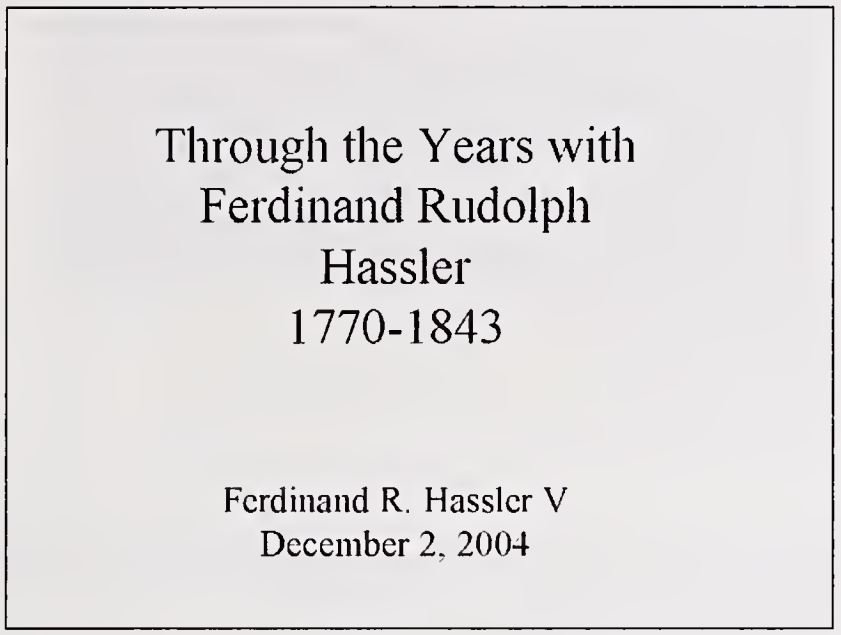
Also about this time in the early 1990s, new buildings were being constructed in Silver Spring to house at one location the many NOAA offices, one of which, the old Coast Survey, also tracks its roots back to Hassler. So, as part of the construction program, it was decided to include a small "pocket park" that was to become the Hassler Memorial Park. And, working with the Hassler family, we were able to have the original Memorial Tablet removed from the cemetery and transported to Silver Spring for possible use in the new park. Some of the Hassler Fund contributions were also applied to that move to make what you see here today possible. As it turned out, NOAA decided on a different course of action; the outdoor location was marked in 1995 with a brass plaque made from a plaster cast of the Hassler bas relief from the original stone and inscribed with the appropriate wording. One man in particular deserves to be recognized now and here. That man is Bill Stanley, who, at the time, was NOAA's historian and had been so instrumental in making the Hassler Memorial Park become a reality. He also had the foresight to find a safe haven for the original Hassler Memorial Tablet at the NIST campus, where it has been kept for precisely the kind of program we are commemorating today.

In closing, I would like to draw your attention to the small inscription at the bottom of the Memorial Tablet that reads: "Designed & Executed by F. H. Strecker." This only became obvious to me late in the project, when the replacement stone was about to be set. The name eluded me for years until I recently discovered that the "F. H." stood for Ferdinand Heinrich, and that he had a son named F. H. (Herman) Strecker. The father had come to this country from his native Germany in 1835 and set up a Monument Works business in Philadelphia. Much like Hassler who had come into that same port just 30 years earlier, Strecker arrived having had practical experience for 26 years as a sculptor of marble in Munich, Rome, and other large cities in Europe. He had studied under Antonia Canova, the famous artist and founder of a new school of Italian sculpture. In 1846, he moved to Reading with his son Herman, born ten years earlier, and set up the Eagle Marble Works of that city. By 1848, Herman began to take up the trade with his father at the tender age of twelve. F. H. Strecker died in 1856, and his son carried on the craft of marble sculpture in one form or another for the rest of his life until his death in 1901. But most interestingly, Herman became as well, if not more so, known for his avocation as an entymologyst, eventually becoming America's most eminent authority on butterflies and moths.

I like to think that this most remarkable man, as a young boy, may have been looking over his father's shoulder in 1848 or 1849, prompting the turn of the elder's sculpting chisel one way or the other to best capture the likeness of Ferdinand Rudolph Hassler.

5.6 *Through the Years with Ferdinand Rudolph Hassler*, by Ferdinand R. Hassler V

Slide 1



I bring greetings on behalf of the Hassler family. My sister, Ardoth, and I are honored to be invited to be part of this dedication. Our cousin, Linda Hassler Reynolds, is also here today from Texas and should specially be recognized as a co-contributor to NIST, along with Ardoth and me, of the family's collection of Hassler's memorabilia and instruments.

Professor Hassler is generally considered as the first scientist employed by the Federal government. As an introduction, let me begin with an overview, from my understanding, of his character and beliefs.

He was the incarnation of devotion to his chosen field of science. He knew no seven or eight hour day. His children wrote of their father often still working at his desk, surrounded by candles, at 2 AM.

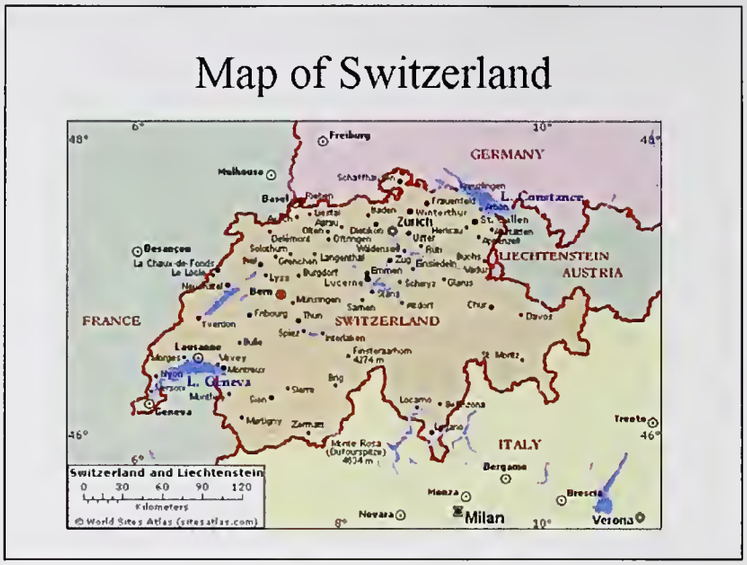
Hassler was a champion of thorough science, and of the dignity of scientific workers. He held to the doctrine that a prosperous government owes its scientific workers a living salary. He felt there must be maintained a high esprit de corps in groups of such workers; and that science provides a most fascinating world to live in, a world above and beyond materialism.

He endeavored to impress upon the public the truth — that delicate scientific measurements require time for their execution, that scientific success is largely dependent upon patience, that "rush orders" for sound scientific output are often impossible.

He stood for the belief that science is not provincial, but international; that science can and should serve as an international tie that binds; that the interchange of science and of scientific workers is a mutual benefit to all nations.

Editor's note: All images from the personal collection of Ferdinand Rudolph Hassler V, unless otherwise noted.

Slide 2

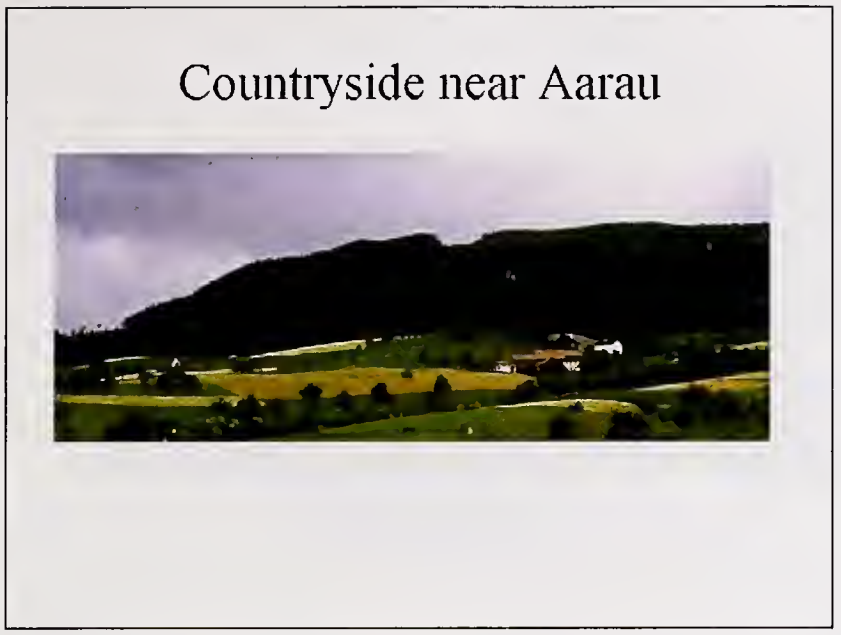


This afternoon, I will endeavor to give you some glimpses through the years, of Professor Hassler's life, focusing primarily on his early years in Switzerland, to further our understanding of the source of his interest in science, mathematics and surveying.

He was born in Aarau, in the northern part of Switzerland, on October 7, 1770
Note the location of Aarau and Bern, the capital. The two cities are about 68 kilometers (42 miles) apart.

His father owned a watch manufacturing company in Aarau. Over the years, the father also filled several of the highest offices within the local municipal governments-- a path of public service that his son also followed in Switzerland. I surmise that Hassler must have been exposed during his youth to the machinery and precision required in watch making. Hassler's love of scientific instruments and great precision may well have been rooted in this family business. In addition, it seems likely that through the father, he was at least introduced to the challenges of being a public servant. Both of these skills were frequently used after Hassler's arrival in America.

Slide 3



Countryside near Aarau. Note the farms and agriculture.

Slide 4

The center city of Aarau. Its population in 1993 was only about 16,000. Interesting to me is that mathematical instruments continue to be listed as one of their main manufacturing products.

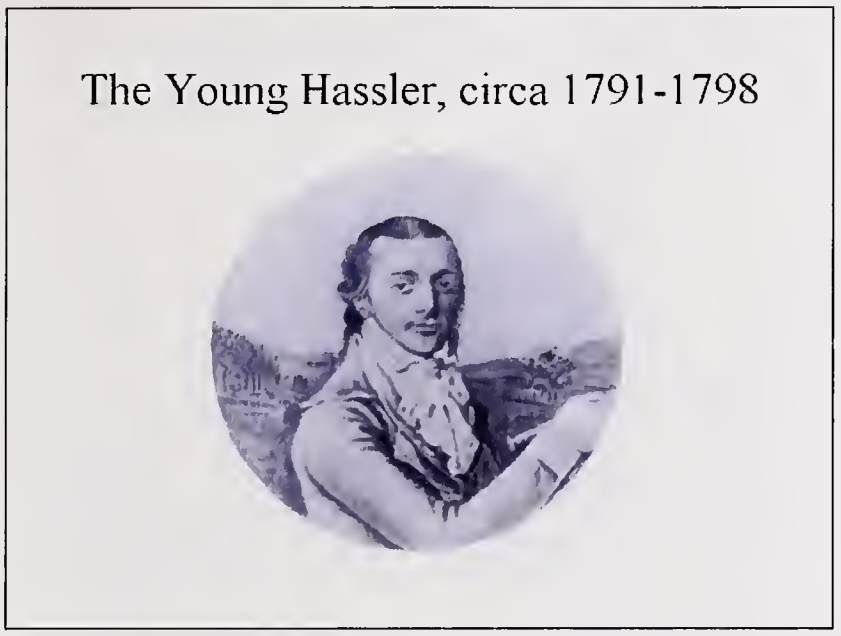
Slide 5

Family church in Aarau where Professor Hassler's birth is recorded.

Slide 6

This slide is sort of an aside. It is the warehouse in Aarau for the Hassler retail stores. His descendents established a series of retail flooring stores in several places across Switzerland. Thus the name is still alive and well in the country.

Slide 7



Here is a portrait of Hassler, in Switzerland, in his early to mid 20s, between 1791 and 1798. These were the years when he finished his schooling at the University of Bern, worked in several administrative posts in the local government and began his surveying work around Bern.

He married on February 17, 1798 at the age of 28 to Marianne Gaillard, a local woman of French descent. In the years that followed, they had nine children — 3 of whom died in childhood.

At the University of Bern, he studied a wide range of subjects including anthropology, mathematics, physics, political science and law. He traveled extensively around Europe and spoke, in addition to the local Swiss-German dialect, Latin, French, standard German and at least some English. It was at the University where he met Johann George Tralles, professor of mathematics and physics. Professor Tralles made a deep impression on Hassler, so that mathematics and geodesy took the place of his intended study of law. This relationship grew from student and teacher to one of a lifelong friendship, and was the source of his learning the science of surveying and measurement.

A month after Hassler's marriage, France occupied this section of Switzerland as part of the ongoing border dispute, involving Germany, France and Switzerland. This occupation disrupted the governmental structure in the Canton, so the surveying work ended. He also lost the other positions he had occupied in the government.

After these events, he and his family decided to come to the United States, along with other Swiss citizens to establish a Swiss agricultural colony in the southern U.S.

Editor's note: Image from NIST Archives, Information Services Division, NIST.

Slide 8

I would like to share with you an engraving of Hassler, I believe around 1810 or so, a few years after his arrival in Philadelphia in 1805. He and his fellow Swiss citizens planned to establish a Swiss agricultural colony in the southern U.S, in South Carolina or Louisiana. The beginning of his immigration journey, noted in his diary, reads, "I left home on the 15th of May 1805 with my wife, children and 101 other persons, plus, my 96 trunks, boxes and bales for the sail down the Rhine River to Amsterdam" and on to Philadelphia. This baggage contained the large scientific library, high quality surveying instruments and various standards of which Dr. Parr spoke. The group arrived in Philadelphia in September of the same year. The journey from Switzerland to America took roughly four months.

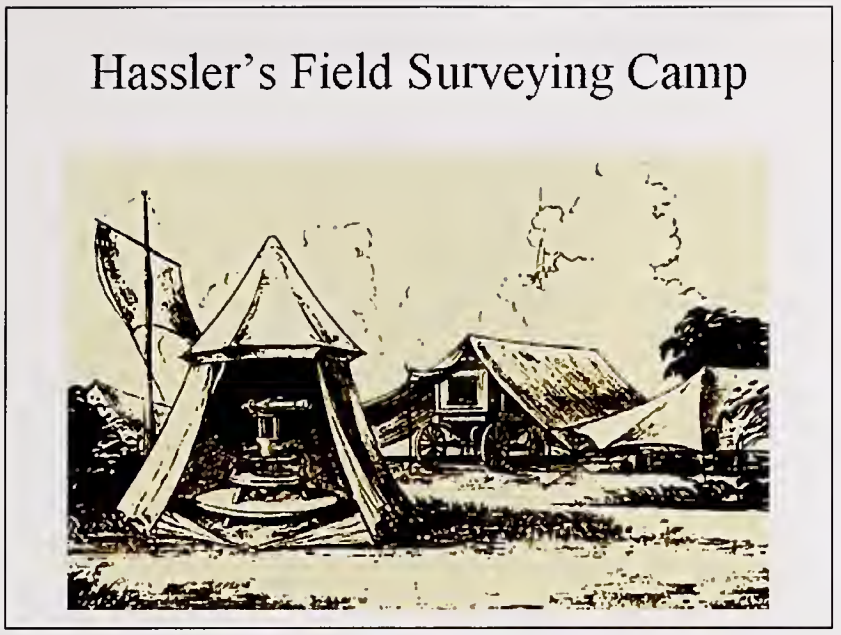
At 35 years of age and a stranger in the new world, he was greeted with a major disappointment. The land agent, to whom the group had entrusted their hopes and money, had disappeared and everything was lost.

His struggle to survive in his new homeland is a fascinating story of triumphs and disasters. Dr. Parr has referred to some of these struggles and his frustrations, particularly with members of Congress and their budgetary constraints. Perhaps, not unlike today! In consideration of time and your patience, I will not go further into details on this phase of his life.

Suffice it to say, that after much preparation and negotiation, Hassler was appointed as Superintendent of the U.S. Coast Survey in 1816.

Editor's note: Image from Ingenieur F. R. Hassler von Aarau*, by Emil Zschokke (Aarau, Switzerland: Verlag Sauerländer, 1877).*

Slide 9



Speaking of the U.S. Coast Survey, here is an interesting drawing from the NIST Archives, of one of his surveying camps that I would like to share.

I should say a word about the "famous carriage" as it is often called. It was highly unusual in shape, and structure. His carriage needed to transport Hassler and his assistants around the streets of Washington DC, as well as across fields, through woods and up mountains. In addition, it needed to be his home, sleeping room and office in the field. Also, it needed to transport his books, field journals and the delicate equipment used in surveying. The shape and structure resulted from Hassler's usual scientific approach to problem solving. He stacked everything to be transported, including his supply of Swiss wine, into a room and then designed an almost square carriage that met the exact space needs. It had a double bottom, for strength. The space between the bottoms was use for storing papers, maps and books. There was a folding carriage top that could be up in inclement weather, or lowered, to pass more easily under low trees. The front swung down to form a desk and office area.

In writings of the time, it is noted that the carriage always attracted a great deal of attention on the streets of Washington.

Editor's note: Image from NIST Archives, Information Services Division, NIST.

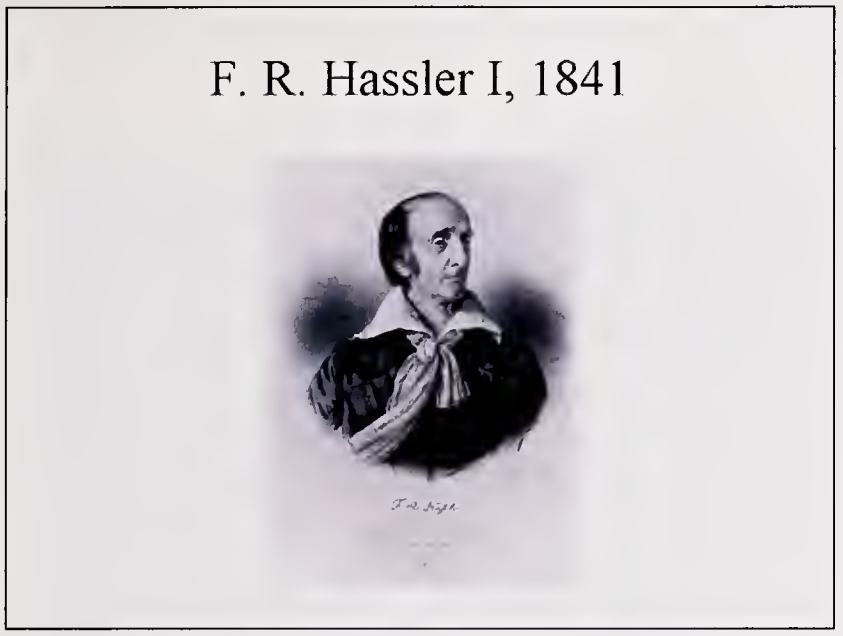
Slide 10

F. R. Hassler, between 1830 and 1841

Next, I want to share this silhouette by Auguste Edouart, a prominent silhouettist of his day. I believe it captures Hassler's appearance as he may have looked at the time of his appointment by President Andrew Jackson in November 1830, as Superintendent of the Office of Weights and Measures.

Editor's note: Image from the group portrait by Edouart (see. p. 99).

Slide 11



Next is F. R. Hassler I, in 1841. This is from a stone engraving by Charles Fenderick, from the family archives. A copy is also in the collection of the National Portrait Gallery.

This engraving was made a mere two years before his death, which took place on November 20, 1843, at age 73, from an injury he received during fieldwork on the Survey. As seems to be typical of his paramount concern for his instruments, he fell on a boulder during a severe storm while trying to protect the theodolite.

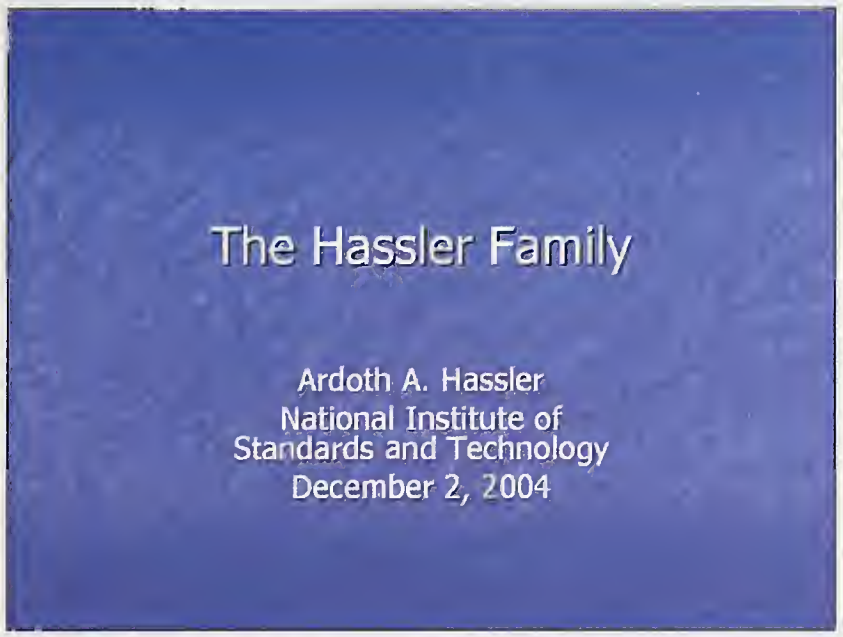
In closing, I would like to quote, with slight paraphrasing, from the book mentioned by Dr. Parr, entitled *The Chequered Career of Ferdinand Rudolph Hassler*, having a subtitle of "A chapter in the history of science in America." The author, Florian Cajori, Professor of the History of Mathematics at the University of California at Berkeley, summarized Hassler by the following statement:

> A man of great practical ability as a scientist, ... a man highly trained in mathematics, ... a man lacking the training of [a] politician, yet able by his earnestness and sincerity to influence public opinion, a true scientist, ambitious for the highest standards of scientific achievement, and never willing to surrender them to the pressing demands of temporary expediency, — such a man was Ferdinand Rudolph Hassler. This rugged figure commands a conspicuous position in the early history of science in America, as the organizer and [initial superintendent of the first two scientific bureaus of the United States — now known as NOAA and NIST.]

Editor's note: Image from an original engraving in the personal collection of F.R. Hassler V. An additional engraving from the same plate in the collection of the National Portrait Gallery, Smithsonian Institution.

5.7 *The Hassler Family*, by Ardoth A. Hassler

Slide 1



Thank you for inviting us here today. First let me say that I am grateful to Bill Stanley of NOAA for asking a question in 1986 about what happened to the Hassler family after Ferdinand Rudolph Hassler I (henceforth called FRH). It started me researching our family history.

Among the first things I learned is that "Hassler" means living under or near the hazelnut tree.

My sources for this talk are *The Chequered Career of Ferdinand Rudolph Hassler* by Florian Cajori, *Hassler Families* by Helen Hassler Dempsey, numerous family papers and oral family history.

Ferd and I, and our cousin Linda Hassler Reynolds, are descended from the oldest son of each generation.

Editor's note: All images from the personal collection of Ardoth A. Hassler.

Slide 2

FRH had nine children; two daughters and seven sons. Three never reached adulthood.

We know that his oldest daughter, Caroline, helped make maps and drawings for him. And, we owe his daughter Rosalie for much of the information we know about the “old man.”

His son, Edward, was described as "his only assistant in the construction of Weights and Measures."

On the right is the family crest depicting branches from the hazelnut tree.

Slide 3

This is silhouette of the Hassler family by Auguste Edouart.

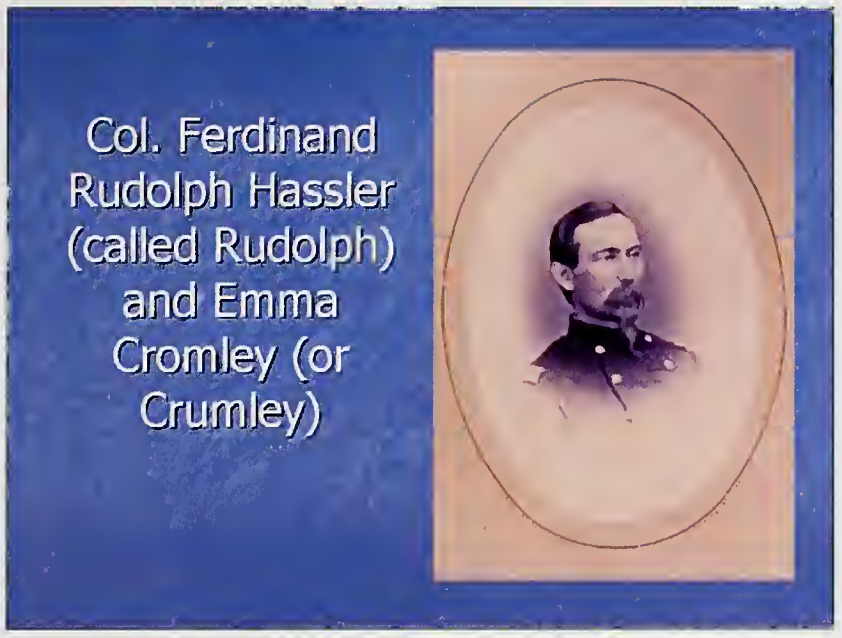
FRH is on the left. His oldest son, John James Scipio, is next to him. The child with the wagon and whip is John James Scipio's son. The rest are FRH's other sons, a daughter, and a daughter-in-law.

Slide 4

We are descended from John James Scipio and his wife, Julia Clarissa Conrad. He was described as an "engineer and was an assistant in the U.S. Coast Survey." He lived in Pennsylvania for a number of years. I understand they are buried in Norfolk, Virginia.

They had three sons — Ferdinand Rudolph II, John J. S. and Frederick William Bessel. They all at one time lived in or near Ripley, West Virginia. All served in the Civil War. The three brothers ran a woolen mill in Ripley.

Slide 5



Ferdinand Rudolph II was the oldest son of John James Scipio. He would have been my great-grandfather. He and his wife, Emma Cromley, had two children.

After completing his education (I believe he was a civil engineer), he joined his father on the Survey.

After John J. S., Sr. died, Ferdinand Rudolph II was surveying in North Carolina with Professor Alexander Dallas Bache, Superintendent of the Coast Survey following Hassler, when the Civil War broke out.

They were made prisoners by the Confederates but were soon released and given safe passage. A few days before their capture, they had packed all the charts they had prepared and smuggled them onboard the last vessel bound to Northern ports.

When they reached Washington, he was assigned to do topographical work for the Army. But he was described as anxious to "smell powder" and soon left to join the Army. He rose to the rank of Colonel.

After the war, he declined to return to the Survey. Instead, he started a woolen mill; later, he ran a lumber mill. He then entered politics. He was elected to the legislature in West Virginia in 1869. He later served as taker of the Census, Postmaster and Sheriff.

Slide 6

"Aunt Estelle" as my father knew her, was the Colonel's older child. She lived in Pittsburgh and I wished I'd paid more attention when my father talked about her!

Slide 7

The son of Ferdinand II and Emma was Ferdinand Rudolph III — my grandfather, on the left in this picture. We did not know him as he died six months after my brother Ferd was born. We did know our grandmother.

Our grandparents were both born and raised in Ripley. Soon after they were married, they moved to Braddock, Pennsylvania, outside of Pittsburgh. He had a steamboat license and ran produce and livestock up and down the Ohio River.

When my father was five, they took the train to Kansas to visit some of my grandmother's relatives, partly because of her health. They liked it and stayed. My grandfather went into business with my grandmother's uncle.

Later, they went to Oklahoma to visit my grandmother's brother and mother (both of whom had made the run into Oklahoma). They also visited Captain John Hassler at Enid. Again, they liked it and stayed — buying and leasing some land near Oilton, Oklahoma.

They moved to Stillwater, Oklahoma about the time my father was ready to enter Oklahoma A & M College (later called Oklahoma State University). Grandfather ran a grocery store there — where this picture was taken.

He also was elected mayor of Stillwater in 1925 and served for three years.

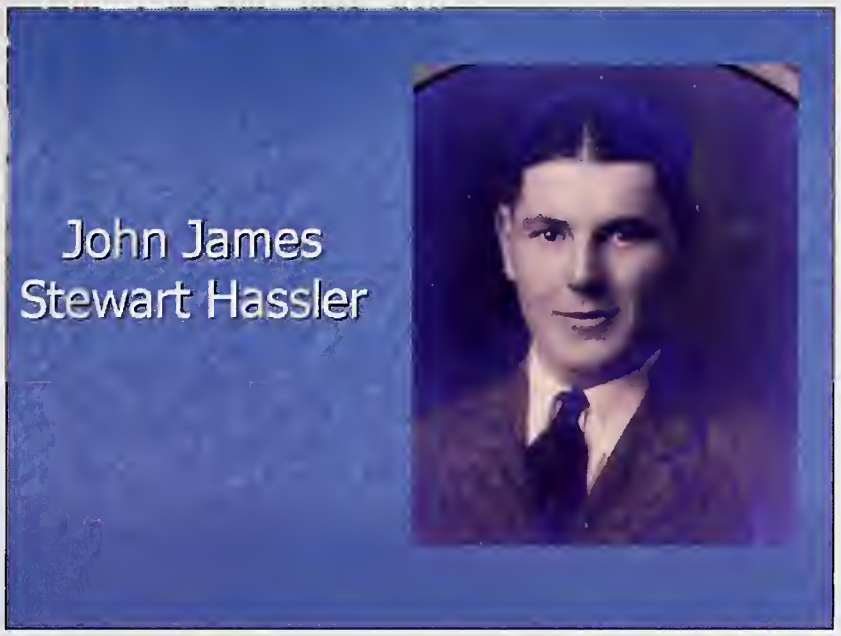
Slide 8

As you've probably figured out, this family names the first son "Ferdinand Rudolph" and the second, "John James." For the FRs, they alternated generations calling them "Ferdinand" or "Rudolph". My Uncle John didn't get the "Scipio"; instead, he got his mother's family name, Stewart.

This picture of my father and uncle is particularly significant in this year of the flu shot shortage and discussions of a pandemic of the bird flu.

Our grandmother had this picture made during a small pox outbreak. There was nothing they could do to prevent the disease, so she had a photograph made of her sons so she could remember them if they died.

Slide 9



Uncle John was a "gas and electric engineer" and later earned his law degree; he was a successful businessman, operating a drilling company in Oklahoma City.

About the time this picture was taken, he was City Manager of Elk City, Oklahoma. At the time, he was the youngest city manager to serve in the U.S.

Slide 10

My father was Ferdinand Rudolph IV, on the left, with his brother, John, seated next to him. Here, they pose with some FRH's instruments that are now in the NIST Museum.

My father was in the first class to graduate from Oilton High in Oilton, Oklahoma. World War I ended during his senior year. When he graduated, he wanted to go to work in the oil fields for the whole sum of $1 per hour but his high school principal persuaded his parents to send him to college. He graduated from Oklahoma A & M in Chemical Engineering and worked for a few years in that field. He later went to Oklahoma University Medical School and then became director of the Oklahoma State Health Department Laboratories. Along the way he earned a master's degree from Johns Hopkins. He served as Director of the Laboratories for 43 years.

Slide 11

We've been privileged to participate in many events focusing on FRH and his work in both standards and surveying.

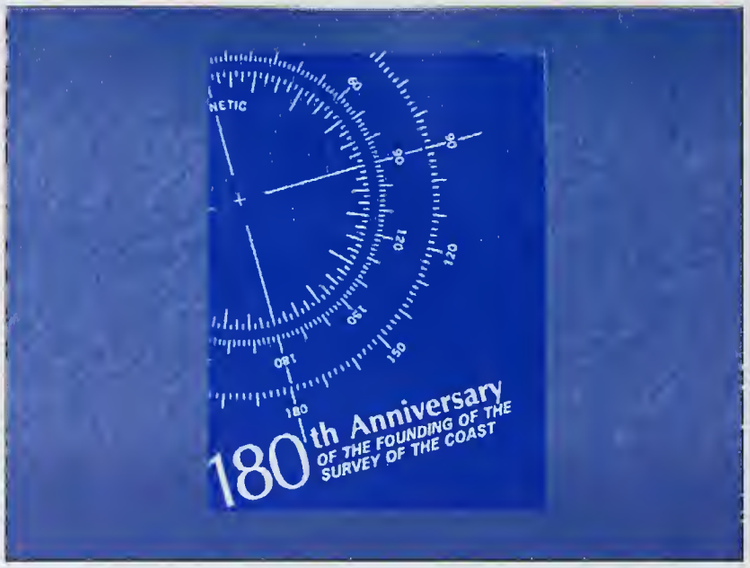
My father corresponded with people at the U.S. Coast and Geodetic Survey about their 150th Anniversary commemoration.

Slide 12

In 1958, the family was at Union College when FRH was named a "Union Worthy".

Members of the family included Hassler Whitney, on the far left, now deceased, a professor of mathematics at Princeton University.

Slide 13



Ferd and I both spoke at the commemoration of the 180th anniversary of the founding of the Coast Survey in 1987.

Slide 14

Several of us were privileged to attend the dedication of one of FRH's original triangulation sites as a National Historic Civil Engineering Landmark.

Slide 15

Here we are again. You've heard about this event from others today.

Slide 16

Again, we were there when the Hassler Memorial Park at NOAA was dedicated in 1995.

Slide 17

We are so incredibly pleased that the Hassler artifacts are on permanent display here at NIST and in cyberspace.

Slide 18

I believe that it is because of our grandmother, Cordia Alice Stewart, as well as Anita Newcomb McGee, granddaughter of FRH's son Charles, and my great Aunt Estelle that we have so much of our rich history.

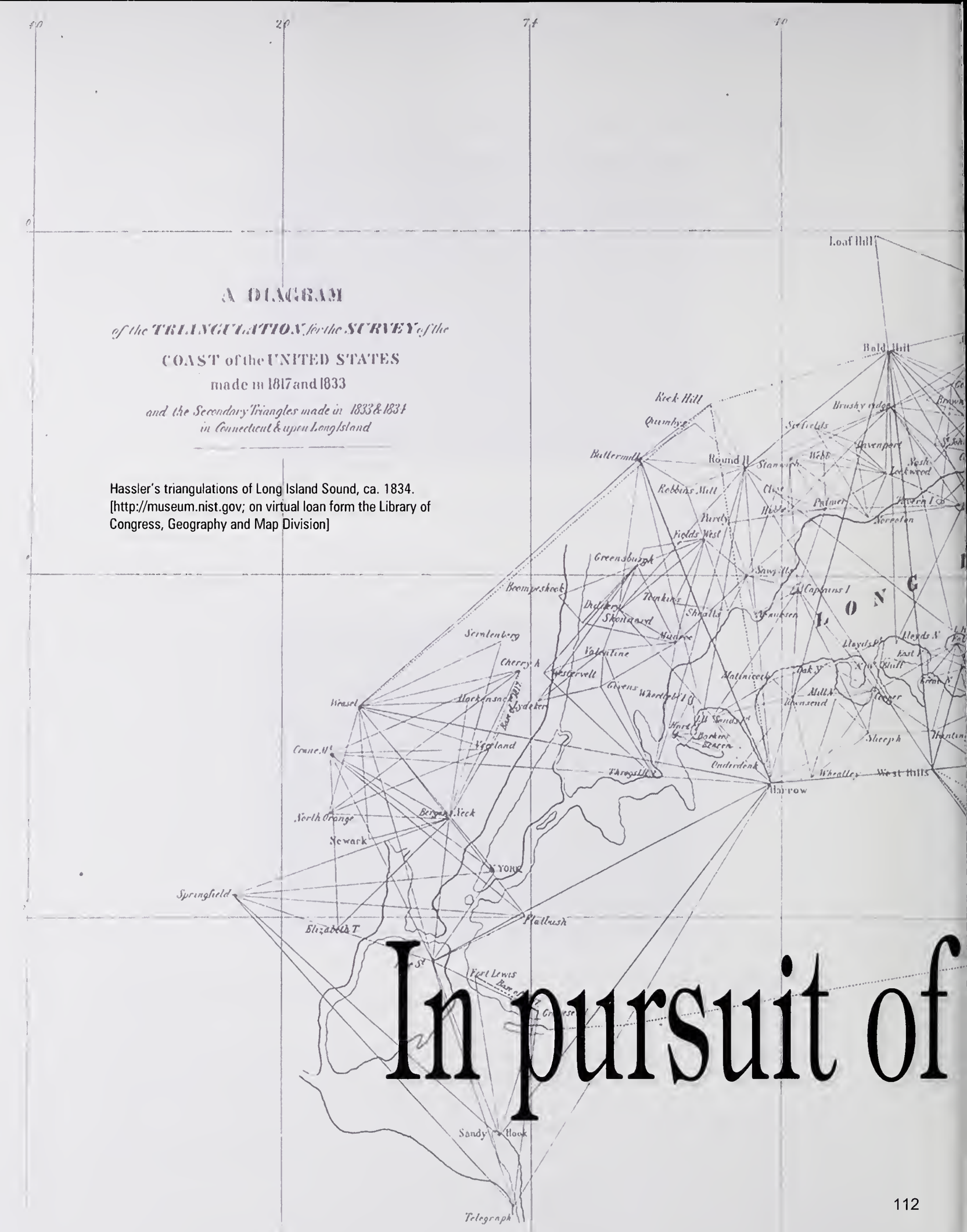
This is our grandmother and a trunk she brought from Pittsburgh to Kansas. In it, she carried some of the Hassler artifacts. As I think about moving, and all the "stuff" we have, that she made space for them shows their importance to the family.

We're so glad that others still appreciate FRH and his contributions. We, his family, will also work to keep those memories living.

5.8 *In Pursuit of Exactitude*, by Ilse Genovese, Communications Director, American Congress on Surveying and Mapping

The following article was published after the 2004 ceremony together with the Remarks of Captain Charles A. Burroughs. Reprinted with permission from: ACSM Bulletin, no. 216 (July/August 2005): 24-26.

This document begins on the following page.



Hassler's triangulations of Long Island Sound, ca. 1834. [http://museum.nist.gov; on virtual loan form the Library of Congress, Geography and Map Division]

In pursuit of

exactitude

—by Ilse Genovese

On December 2, 2004, in a little advertised ceremony at the National Institute of Standards and Technology in Gaithersburg, Maryland, a remarkable man was honored. This man was none other than the first Superintendent of the Survey of the Coast, Ferdinand Rudolf Hassler.

Born in Switzerland in 1770, Hassler studied mathematics, astronomy, and geodesy at the Technical Institute in Bern. He emigrated to the United States in 1805 and soon after became a U.S. citizen. In 1807, President Jefferson asked Hassler to direct the Survey of the Coast, and nine years later, President Madison appointed him the Survey's first Superintendent.

Back in 1807, Hassler was one of many surveyors who had responded to a request made by the then Secretary of the Treasury, Albert Gallatin, for proposals to survey the East coast of the United States. His plan—a triangulation survey incorporating several, at the time, advanced geodetic techniques—was quite unparallel to any plans that had been submitted.

And so began Hassler's long involvement with the nascent scientific enterprise of accurately measuring the United States of America.

In the early 18th century, communication and commerce along the Atlantic Coast of the U.S. was conducted by sea; to better connect the industrial centers along the young Republic's eastern shoreline, an accurate and comprehensive survey was deemed necessary. Hassler's proposal fit the bill, and he got the job about five years after submitting his plan.

One of Hassler's first actions as the superintendent of the Survey of the Coast was to equip the Survey with then "cutting edge" instruments and scientific information. He traveled to London and Paris, where he bought instruments from the most reputed makers, often ordering custom features of his own design and instruments of his own invention. He exceeded the spending limits that had been set for the trip, which did not win him many friends among a young, frugal American Government. And after just two years of directing the first truly scientific

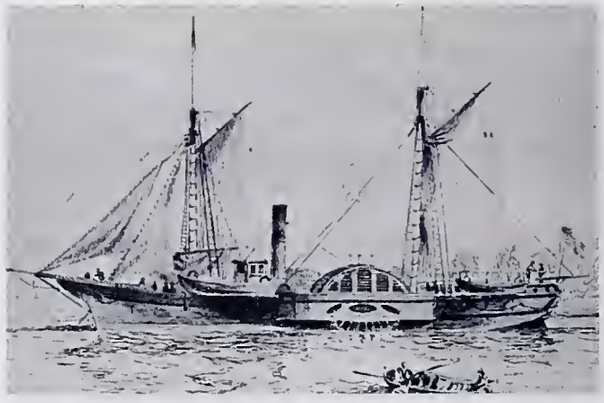
survey on American soil, the Survey of the Coast was removed from Hassler's supervision.

It took 14 years of a poorly coordinated and technically flawed survey under military control to re-establish the original Survey of the Coast and bring Hassler back to its helm, this time as the first Superintendent of Weights and Measures. His return to the Survey in 1832 was fortuitous as he had by then conducted, at President Jackson's request, a comparison of the weights and measures used at the Nation's principal custom houses, thus setting the stage for systematic accounting of weights and measures in the United States.

Hassler's metrological interest and activities fitted well with the Coast Survey's endeavor to conduct accurate surveys based on precise measures. When he was comparing the custom houses' length measures, Hassler used an iron bar made in 1799 by a Committee of the French Academy of Sciences. He employed the same "Committee Meter" to measure base lines for the Coast Survey. It was on one of such field surveys in 1843 that Hassler contracted an illness and died at the age of seventy-three, pursuing exactitude in measuring the young American Republic.

The Office of Weights and Measures that he had headed remained in the U.S. Survey of the Coast (subsequently the U.S. Coast and Geodetic Survey) until 1901, at which time its functions were transferred to the new National Bureau of Standards, now the National Institute of Standards and Technology (NIST). Back in the 1830s, history was made. For, it was while European visitors were taking the measure of the young American Republic in a figurative sense, Hassler was measuring it quite literally, using new standards of surveying accuracy.

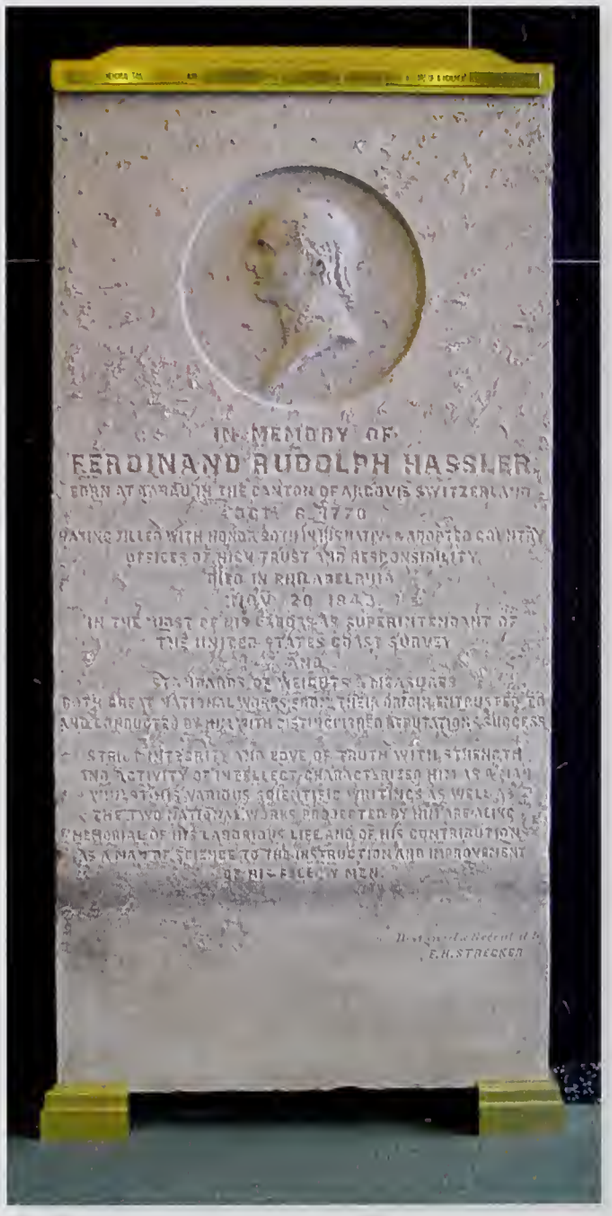
[With quotes from Ferdinand Rudolph Hassler, 1770-1843: Measuring the Young Republic, edited by Lisa A. Greenhouse, NIST, Gaithersburg, Maryland, April 1998.]



The Coast Survey steamer Bibb [NOAA photo library].

In December 2004, the geodesist and metrologist who inspired the Nation's journey toward better standards in surveying and other engineering fields, was honored with a commemorative tablet. A final piece of the origins of our Nation's standard-setting institution fell in place. The story about the memorial tablet honoring the life of Ferdinand Rudolph Hassler and how it came to rest at NIST was narrated by Capt. Charles A. Burroughs, NOAA (retired), in remarks he had made at the ceremony.

The original memorial tablet shown below now resides in the main lobby of the Administration Building of the National Institute of Technology in Gaithersburg, Maryland, largely due to the efforts of Dr. Albert C. Parr, Chair of the NIST Museum Committee.



6. Donation of Hassler's Report to the NIST Research Library, June 22, 2006

6.1 Overview

In June 2006, a dual-purpose event was held at NIST headquarters in Gaithersburg, Maryland. The first purpose was the opening and dedication of the Hall of Standards in the main hallway of the NIST Administration building. The Hall of Standards, part of the NIST Museum, highlights NIST's work in developing measurement standards. Held in conjunction with this event was a ceremony to mark the donation to the NIST Research Library of a rare copy of Hassler's 1832 *Comparison of Weights and Measures of Length and Capacity Reported to the Senate of the United States by the Treasury Department.* This copy is inscribed on the title page by Hassler's own hand. The donation was made by Dr. Albert C. Parr, Chief of the Optical Technology Division and Chair of the NIST Museum Committee. Dr. Parr wrote about how he acquired and researched the history of this unique volume in his article "A Tale About the First Weights and Measures Intercomparison in the United States in 1832," included in this section. Following the donation, the volume was exhibited in the Hall of Standards.

Top: Dr. Albert C. Parr passes the Hassler report to Mary-Deirdre Coraggio, Chief, NIST Information Services Division. Bottom: Dr. Parr, Ms. Coraggio, and Harriet Hassler of the NIST Research Library place the report on exhibit. (Photos: Denease Anderson, NIST)

6.2 *A Tale About the First Weights and Measures Intercomparison in the United States in 1832*, by Dr. Albert C. Parr, Chair, NIST Museum Committee; Division Chief, NIST Optical Technology Division

Reprinted from: ***Journal of Research of the National Institute of Standards and Technology*****. 111, no. 1 (January/February 2006): 31-40.**

This document begins on the following page.

Volume 111, Number 1, January-February 2006
Journal of Research of the National Institute of Standards and Technology

[J. Res. Natl. Inst. Stand. Technol. **111**, 31-40 (2006)]

A Tale About the First Weights and Measures Intercomparison in the United States in 1832

Volume 111 Number 1 January-February 2006

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In preparation for the Hassler memorial tablet dedication in the National Institute of Standards and Technology (NIST) Administration Building lobby in December of 2004, I learned that Ferdinand Rudolph Hassler had carried out the first systematic study of weights and measures in the United States. I obtained a copy of *Comparison of Weights and Measures of Length and Capacity Reported to the Senate of the United States* which is Hassler's 1832 report to Congress on this comparison that related all the weights and measures then in use by the states and federal customhouses. Handwritten inscriptions in the book reveal interesting facts about Hassler's work and his communication with other scientists in Europe at that time.

Key words: Hassler; history; intercomparison.

Accepted: January 4, 2006

Available online: http://www.nist.gov/jres

1. Introduction

Ferdinand Rudolph Hassler immigrated to the United States in the late summer of 1805 with his family and other Swiss emigrants, seeking to start a new life and escape the conflicts brought on by the French revolution in the late 18th century. Hassler, born in 1770 in Aarau, Switzerland, was a trained scientist with expertise in surveying and astronomy, and an accomplished mathematician. His family was prominent in Aarau and their financial position and local influence enabled Hassler to utilize his considerable talents in a variety of government service positions. Among them was the task of surveying local districts for the Swiss government. He had extensive travels in Europe prior to his immigration to the United States and, due to his travels and accomplishments, was known to a number of prominent European scientists and scholars. When he immigrated to the United States he brought a large scientific library and a number of high quality surveying instruments as well as standards of mass, length and volume that were accurate replicas of those being used in Europe in the late 18th and early 19th centuries [1,2].

Hassler died in 1843 and as a tribute to his leadership and accomplishments the members of the Coast Survey erected a stone monument in the late 1840s at the Laurel Hill Cemetery in Philadelphia where Hassler was buried. The Hassler family and friends replaced the original stone with a new stone in 1993 due to the fact that the original stone was showing signs of weathering after 150 years of exposure to the elements. The original commemorative stone was donated to NIST for its Museum collection. In addition to his duties as head of the Coast Survey, Hassler started the Bureau of Weights and Measures at the direction of President Jackson in 1830. When the Bureau of Standards was started by congress in 1901, it assumed the functions of the Bureau of Weights and Measures that was a part of the

Coast Survey. In his role as the first Superintendent of the Bureau of Weights and Measures, Hassler must be considered the originator of the standards and measurement work that NIST now performs. It is a fitting tribute to Hassler's contribution to weights and measures in the United States that NIST was able to place the historic commemorative tablet in the Administration Building Lobby in a December 2004 ceremony. As chair of the NIST Museum Committee, I participated in the preparation of this ceremony and became better acquainted with Hassler's contributions to science in the early United States.

Hassler's many accomplishments and the numerous problems he overcame are well documented in his biographies [1,2]. Additionally, the Treasury Department's Coast Survey preserved many of his official letters and reports that were published as Weights and Measures documents [3]. The NIST Research Library has a copy of some of the Weights and Measures Documents for the early Coast Survey, which contains Hassler's reports and correspondence with his colleagues. In particular, the collection of documents for the period of 1832 to 1845 covering the time of the weights and measures comparison greatly aided the efforts reported here.

Hassler carried out the first survey and comparison of weights and measures in use in the early United States and provided a report to Congress in 1832 that was presented through the Secretary of the Treasury under whose department Hassler was assigned [4]. These reports were printed as a part of the Congressional Record and copies were made available to Hassler. Hassler communicated directly with the Secretary of the Treasury, the President, and members of Congress as the occasion required. During his service to the country in the early 19th century Hassler was able to meet directly with the various presidents and treasury secretaries as needed. Much of this official correspondence is preserved in the Coast Survey documents. While participating in the installation of the Hassler tablet in the Administration Building lobby and preparing the dedication ceremony, I became interested in getting a copy for my personal library of Hassler's 1832 report on the weights and measures comparison. I located and purchased a copy on the web that was advertised by a bookseller in Germany. The book, shown in Fig. 1, turned out to have some interesting historical tales that offer insight into the activities of Hassler and others engaged in early measurement and standards work. This paper highlights the interesting historical connections discovered about this particular book.

Fig. 1. Photograph of Hassler's report on weights and measures titled, *Comparison of Weights and Measures of Length and Capacity, Reported the Senate of the United States by the Treasury Department in 1832.*

The book has two hand-written inscriptions, one on the inside front cover and the other on the title page. Figure 2 is the inscription on the inside front cover and reads in German:

Von Herrn Admiral von Krusenstern
mir als Geschenk übersandt
Im August 1833
Pauker

Translated into English this inscription says:

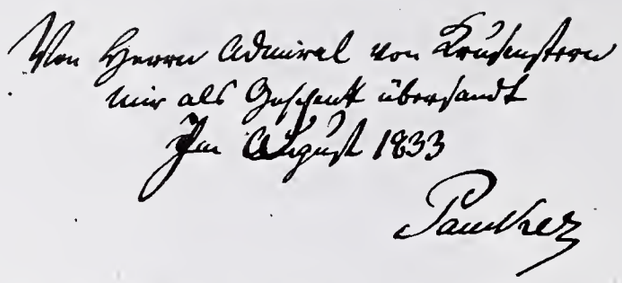

Fig. 2. Inscription inside the front cover of the book shown in Fig. 1.

"Sent to me as a present by Admiral von Krusenstern
in August 1833
Pauker"

Figure 3 shows the inscription on the title page of the report. It is in English and says:

"At the disposition of Admiral Krusenstern". (Note: In early printed and written English the letter "s" was often written as "f" as shown in Fig. 3)

With the help of colleagues at NIST, I have managed to piece together what these inscriptions imply about Hassler's communication with other scientists of the time, and place this particular copy of the Weights and Measures report within its historical context. Dr. Alfons Weber, a Scientist Emeritus in the Optical Technology Division, has been a critical and essential participant in this story as he deciphered the old German script in the book as well as other early German material we obtained elsewhere. I am indebted to his help in unraveling this fascinating story about early metrology in the United States. Ms. Harriet Hassler of the NIST library has been extremely helpful in locating material about her distant relative that has been invaluable for this effort.

2. The Principal Persons Involved in the Story

The people whose names appear in the two inscriptions, Krusenstern and Pauker, were contemporaries of Hassler and were well-known scientists who both had an interest in mathematics, surveying, and weights and measures. Brief histories of them and of Edward Troughton, who is mentioned in correspondence we obtained between Hassler and Krusenstern, are given.

3. Krusenstern

Adam Ivan Krusenstern was a well known Russian navigator and admiral born in Estonia in 1770, the same year as Hassler, but spent most of his professional life in the service of the Russian Navy [5]. Krusenstern (also spelled Kruzenshtern) had interests in geography and surveying, as did Hassler. Krusenstern is most noted for his 1803-1806 circumnavigation of the earth, the first for a ship of the Russian Navy. During this voyage he made numerous stops for scientific and cultural exploration, including Pacific islands and Japan, and published a narrative of his journey and observations which became a reference for diverse scientific fields from anthropology to surveying of coastlines [6]. A likeness of Krusenstern in Naval uniform is shown in Fig. 4. Krusenstern and Hassler corresponded as a result of meeting each other when they were both in London in 1814-15. Hassler's biographer Cajori mentions the meeting, which is also mentioned by Krusenstern in one of the letters, preserved in the Coast Survey documents. In a letter dated March 6, 1831 in response to a letter from Hassler, Krusenstern says:

"I remember very well that I made your acquaintance in 1814 and '15 at old Mr. Troughton's, and frequently I have tried to obtain information on your intended Survey of the Coast of America, for which you had the instruments made in London, ..."

With the help of Dr. Alexander Prokhorov, a guest scientist in the Optical Technology Division who comes from Russia, we obtained copies of letters written by Hassler to Krusenstern during the period of 1831 to 1841 from the Russian Naval Archives in St. Petersburg. In addition to the letters from F. R. Hassler, the archives furnished a copy of a letter from Hassler's son to Krusenstern informing the Admiral of his father's death in November of 1843.

Hassler had gone to London at the request of the United States Government in August of 1811 to procure instruments for surveying the coast of America. Hassler had a long and troubled relationship with the United State Government over the execution of the Coast Survey, which vexed him throughout most of his life in the United States. Cajori's biography details some of the troubles Hassler had over the Coast Survey as does the material in the Coast Survey documentation [1,3]. However these tribulations are not the focus of the present discussion, which is focused on Hassler's interaction with Krusenstern. Hassler and Krusenstern were

22d CONGRESS, 1st Session. [Doc. No. 299.] Ho. OF REPS.

COMPARISON

OF

WEIGHTS AND MEASURES

OF 4374

LENGTH AND CAPACITY,

REPORTED TO

THE SENATE OF THE UNITED STATES

BY

THE TREASURY DEPARTMENT IN 1832,

AND MADE BY

FERD. ROD. HASSLER,

M. A. P. S., ASS. R. AST. S. L., &c.

EX BIBLIOTH SOC. LITER CURIEN

WASHINGTON:

PRINTED BY DUFF GREEN.

1832.

At the disposition of Admiral Krusenstern

Fig. 3. Title page of book shown in Fig. 1 that has inscription by the author and a library stamp.

Fig. 4. Likeness of Admiral Krusenstern of the Russian Navy obtained from the following website: http://www.mala.bc.ca/~black/amrc/krusen.htm. This website is maintained by Professor John Black, Malaspina University College, Nanaimo, B.C., Canada, and this image is used with his permission.

both in London at the same time procuring a wide range of surveying instruments including transits, sextants and heliotropes for use in their respective countries. This trip took Hassler much longer than anticipated and was made more difficult by the outbreak of the War of 1812. Hassler returned to the United States with his instruments and other scientific items in 1815 upon the cessation of hostilities between Britain and the United States.

4. Troughton

Edward Troughton was born in 1753 and joined his older brother John in a scientific instrument maker's shop in London that the older Troughton had started. John died in 1788 and Edward assumed the management of the shop and was the principal designer and engineer. The brothers had built a precision dividing engine that enabled them to provide the highest quality sextants and other precision instruments for surveying and navigation [7]. Edward continued to build the business after his brother's death and established a reputation as the best instrument maker in England if not all of Europe. He constructed instruments for the leading scientific organizations at the time and his fame and expertise is what brought both Hassler and Krusenstern to London in 1814 to procure precision instruments for their work. Troughton also manufactured standard weights and standards of length. Hassler procured some of these items and they became the property of the Bureau of Weights and Measures in the Coast Survey and some now reside in the NIST Museum. Troughton retired from the firm in 1826 due to failing health and died in 1835. The firm continued for many years as Troughton and Simms and later as Cooke, Troughton and Simms, until the operations of the firm were merged into larger businesses in the mid 20th century.

5. Pauker

Magnus Georg Pauker (also Paucker) was a contemporary of Krusenstern and Hassler being born in 1787 and dying in 1855 [8]. He graduated from Dorpat University, now called Tartu University, in Estonia and had similar interests to Krusenstern and Hassler. He participated in land surveys and taught mathematics at the Academia Petrina. Pauker also participated in weights and measures intercomparisons as we learn below from Krusenstern's letter to Hassler. In this letter Krusenstern informed Hassler on how he had distributed the reports on weights and measures that Hassler had sent him. Pauker also was instrumental in organizing the first scientific society in Latvia, called the Kurland Society, and published various mathematically related papers in Latvia and Russia. Pauker, together with Krusenstern and a number of other prominent scientists whose families had immigrated to the Baltic States from Germany were collectively were known as the Baltic Germans. There was a large German influence in the Baltic area beginning in the Middle Ages as a result of the spread of Christianity and to satisfy German interests at increasing commerce in the Baltic area. This influence grew when Peter the Great of Russia encouraged commerce with northern Europe, in part to help establish a Russian Navy based in St. Petersburg. Peter and some of the later Tsars encouraged German migration to Russia to facilitate the improvement of Russian technology and decrease Russia's traditional isolation from the west. The Germans were granted a great deal of autonomy and established German language institutions in the Baltic and in Russia. This relationship lasted until the late 19th century when the political climate changed in Russia and a great many of the ethnic Germans left.

6. Weights and Measures Report

Prior to the inception of the income tax in the early 20th century, the United States Government was financed by duties on imports and exports. A reliable and uniform system of weights and measures was important for gathering taxes as well as settling commercial disputes. The federal government maintained a system of customhouses for determining appropriate import and export taxes on items of commerce. In his report to Congress, Hassler lists 47 customhouses for which he compared the bushel used for volume determinations. Hassler found the mean volume to be 2153 cubic inches, with variation as much as almost 100 cubic inches. He compared the various units of length in use at that time in United States commerce including the French toise, the Troughton standard scale of about 82 English inches, and various European length scales. Hassler had procured the Troughton standard for the Coast Survey in London during his stay of 1811-15. He constructed a dividing instrument to accurately divide up the length units in order carry out the measurements. Hassler also developed and built barometers and thermometers so that appropriate barometric and temperature corrections could be made to the measurement. He measured coefficients of expansion and other pertinent thermal properties of the materials he used in the construction of his instruments to assess temperature effects on the measurements. It is interesting to note that Hassler was able to borrow from the American Philosophical Society in Philadelphia some of the standards that he sold to them when he first arrived in the United States in 1805. He was forced, shortly after arriving in the United States, to sell many of his instruments and standards as well as a portion of his library material to support himself and his family. Hassler and his Swiss emigrant colleagues were the victims of some sort of misappropriation of their funds by a land agent whom they had relied upon to buy them land in Georgia for a new Swiss settlement. Hassler and the other Swiss never made it to Georgia as a group and Hassler spent his life in the pursuits we have mentioned.

Hassler had brought to America, when he emigrated in 1805, a newly constructed meter that the French had produced as a result of the survey of France in the 1790s [9]. The meter was defined as one ten-millionth of the distance from the equator to the pole and hence ambitious surveys were carried out by the French and others to obtain this quantity precisely. The first meter bar was called a Committee Meter since it was defined by a committee of French scientists. During the upheaval of the French revolution many aspects of French life were governed by committees who performed functions previously the responsibility of the King's appointees. The Committee Meter that Hassler brought to the United States is on display in the NIST Museum.

To carry out his comparison of weights, Hassler constructed instruments to augment those he purchased abroad. Among the items constructed were some mercury balances which functioned by displacement of mercury by a large float attached to a weighing pan for the unknown weight. The device was calibrated with known weights prior to use. For less massive weights, water could be used as the liquid in this type of device. Hassler set up instrument shops in Washington DC and employed and trained instrument makers to construct instruments and weight and volume sets for the various states as required by his charge from Congress. He adopted the troy pound of Great Britain as the standard of weight for these measurements. The Mint had a copy of this standard manufactured at the request of the United States Government in 1824 [4]. Hassler realized the importance of knowing accurately the expansion properties of water and mercury and performed experiments on the substances to determine the appropriate coefficients. Hassler was able to make excellent measurements; for example he derives the yard from the Troughton scale as 36.0002465 inches. This number indicates the precision that Hassler tried to achieve in his comparison of the weights and measures.

The report to Congress contains all the results from the various customhouses for both their volumetric and length standards. Additionally Hassler generated tables that allowed the conversion of the various units used at the time among themselves. For example he gives the "authentic meter of the committee" as equal to 39.3842349 inches at a temperature of 39.8 degrees Fahrenheit. The comparison work provided data for the relationships of the weights and measures from the various customhouses for all of their measurements, including the ounces, grains, bushels, and other units commonly then in use.

For his effort as the superintendent of the Bureau of Weights and Measures, Hassler was paid $3000 per year [3]. He was given additional allocations to purchase instruments and hire assistants. $3000 per year was a significant salary in the mid 1800s. Hassler paid his assistants much less, less than $1000 per year in some cases. When he was heading the Coast Survey in 1840, he was paid $4500 per year and assistants were paid from $780 to as much as $4000. In some cases these people had to support themselves while on the field surveys and pay for other expenses associated

with the survey. The cost of the survey and his spending were issues that caused friction between Hassler and Congress throughout his career and led to many disagreeable exchanges between Hassler and various congressional and governmental officials.

The other major conflict he had was in the disagreement over the surveying technique used in the Coast Survey. Accurate chronometers had been designed in the 18th century for use in navigation and there were a number of people in the Navy department who proposed the chronometric technique for the coast survey [10]. With an accurate chronometer and sextants, one can, as does a navigator aboard a ship, determine the longitude of any position on the earth. The latitude can be determined with a sextant and a measurement of the angular position of Polaris, the North Star. Hassler conversely believed that the triangulation method used in land survey was most accurate and was the only one that could produce reliable and accurate maps. This disagreement about methodology caused the Coast Survey to be put in the Navy Department at times and then, when Hassler prevailed, put back in the Treasury Department. The story of Hassler's difficulties is well documented by his biographer Cajori and is on an excellent website maintained by NOAA [1,11].

7. Hassler and Krusenstern

Hassler knew from his meeting with Krusenstern in London in 1814 that the Admiral was interested in surveying techniques since they were both at Troughton's for the same purpose. The unit of length is of course critical to surveying and the relationship of the different units used throughout the world would naturally lead Hassler to assume that Krusenstern would be interested in his report on the weights and measures in the United States. Hassler wrote to Krusenstern in a letter dated January 2, 1833 that we obtained from the Russian Naval Archives:

"In the meantime I had the comparison of Weights and Measures of which I join here the report, in a number of copies to different directions, which Baron von Sacken is so kind to take under his charge, with the present, the inscriptions show their destination. (there are 7)"

The phrase, "in the meantime" refers to what he has been doing since the Coast Survey was removed from his control and placed with the Navy. Later in the letter, Hassler asks Krusenstern to convey one copy of the work to his old university friend, Mr. Bartels in Dorpat. Dorpat is the former name of what is now called Tartu in Estonia. Bartels was most likely Johann Martin Christian Bartels who was a friend of Karl F. Gauss and other mathematicians of the early 19th century. Bartels taught at Dorpat University and was an older student with Gauss when they were students together in Braunschweig, Germany [12]. Bartels' daughter married the famous mathematician Friedrich Struve. I do not have good information on who Baron von Sacken was and how he fit into the picture other than acting as a courier for Hassler and Krusenstern. At this period in history the mail services were a complicated set of government and private courier arrangements and it was often difficult to arrange for packages and letters to be sent between countries. Exchange of mails between countries based upon stamps purchased at the origin did not become formalized worldwide until the Universal Postal Union was established in 1874. Certainly it was difficult for Hassler to send material from America to Europe at that time. The courier would have to be paid in advance and often the recipient was asked to pay fees as well. In one instance that Hassler refers to in his letters, he shipped some books to Europe but the customs in England where they first arrived did not get sufficient payment or there was some other discrepancy and the whole shipment was apparently burned.

Other parts of the letter deal with an effort by Hassler to sell Krusenstern copies of his mathematical works, primarily his logarithmic and trigonometric tables for use in the Russian Navy. After some effort, apparently this commercial endeavor worked out to everyone's satisfaction. Hassler's mathematical books gained widespread circulation and the money generated by sales was a source of income for the Hassler family between his appointments with the United States Government and other jobs he held.

In a letter dated July 11, 1833, Krusenstern states:

"Your letter dated New York, 2d January, reached me very late; it is not above six weeks since I received it, through Baron von Saken(Sacken). Pressing business on service, and an absence from St. Petersburg, have prevented me to answer sooner your letter, and to return my most obliging thanks for the copy of your Report on Weights and Measures, which you have done me the favor to send. The other six copies I have delivered to those persons to whom they were destined. One of the two copies you left to my option I shall send to Professor Pauker, at Mittau(Mitau), who has published lately a voluminous work on the same subject that has won the prize of Demidof, adjudged by the Academy of

Sciences. He will consider your book a valuable gift; for it is indeed the production of a master, which reputation you deservedly enjoy in Europe as well as America."

This comment makes it clear that the copy of the Weights and Measures comparison that I obtained is one of the two that Hassler sent Krusenstern for his own use. The inscription shown in Fig. 3 is a dedication by Hassler that this volume is to be used for whatever purpose Krusenstern desires. Figure 5 is an excerpt from the letter that Hassler sent Krusenstern dated January 2, 1833. The excerpt is from the final page of the letter and shows Hassler's signature as well as his address designating the recipient of the letter: Admiral Krusenstern of St. Petersburg. Comparing the style of the writing of Krusenstern's name in the inscription in Fig. 2 and at the end of the January 2nd letter I obtained from the Russian Naval Archives makes it clear that Hassler, as he said in his letter to Krusenstern, inscribed on the volumes their intended destination. Krusenstern probably kept one of the two copies and sent the other, the one described here, to Professor Pauker. When I first obtained the book, I was mystified why the writing on the title page appeared to be of the same vintage as that on the inside cover but yet was in English when Pauker and Krusenstern would normally be expected to have written in German. It was a pleasant surprise to find the book is a dedication copy inscribed by the author, F. R. Hassler.

The title page that contains Hassler's inscription as shown in Fig. 3 has a fold out portion that protrudes beyond the page boundary. This occurred, I would guess, because the book was probably printed on large paper stock with more generous margins and when it was bound, probably by Krusenstern or Pauker, the binder preserved the inscription by folding it in when he cut the margins to fit a smaller binding. Trimming a text block was a common practice of binders in the 19th century, and earlier as well, as it made the expense of the binding less and thereby saved the owner money. In early printing, books were often supplied by the printer to the author in a simple paper binding and the purchaser would have a cloth or leather binding made to suit his particular library. For the actual printing, the printer used whatever paper size was available to accommodate the page of text as laid out. In some cases this resulted in books with very wide margins that would be trimmed by the binder.

In a letter from Pauker to Krusenstern dated August 10, 1833, Pauker notes that he received the book of Hassler but was too busy to pursue it at the time. The letter is in German and is difficult to read because of the quality of the photocopy and the fact that in the original letter both sides were used. The ink of course penetrated the paper and makes an impression on both sides of the paper. This effect can be seen in the excerpt in Fig. 5. The bleed through of the ink makes photocopying difficult and since we do not have access to the originals, it is hard to decipher the full content of the letters. The Hassler letters to Krusenstern had similar problems, particularly the ones written in German. The Pauker letter discusses with Krusenstern his efforts in weights and measures and is about measurement com-

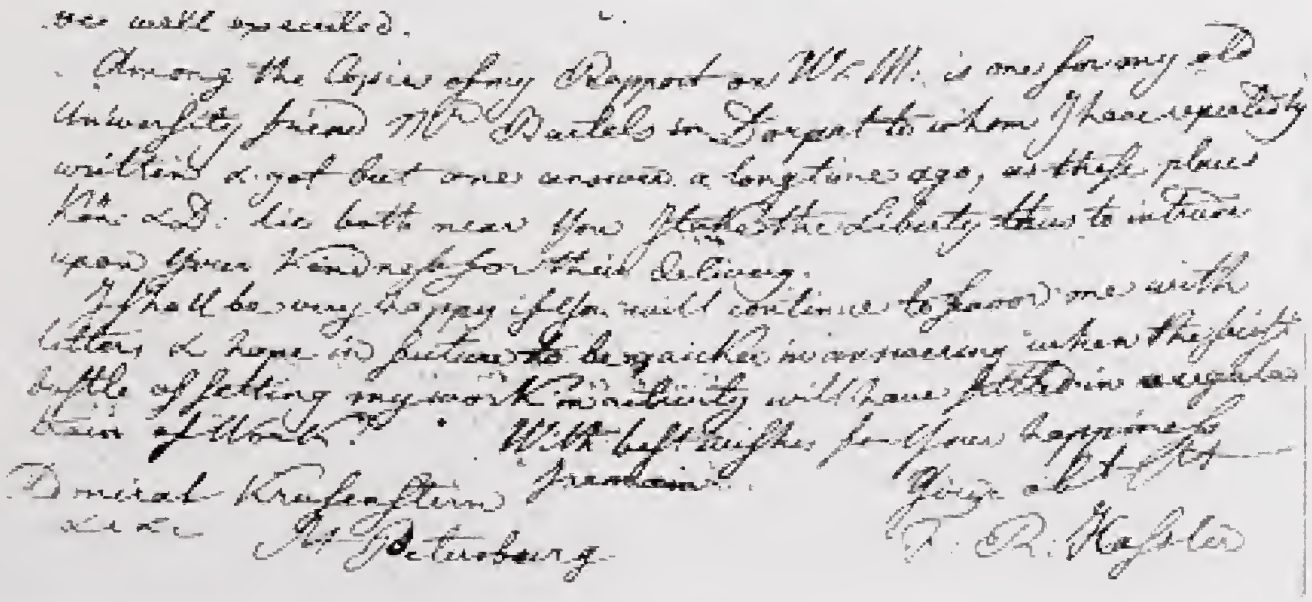

Fig. 5. Copy of the last page of a letter Hassler sent Krusenstern on January 2, 1833 and which shows the writing of Krusenstern's name is the same as the inscription in the figure.

parisons in the Baltic area. Pauker's other letters to Krusenstern are mainly about his efforts to have his son enrolled in the Russian Navy in order to become an officer. This, it seems, was eventually successful.

8. Conclusion

One of the pleasures resulting from book collecting is the unexpected information the collector often learns when pursuing a particular book and its origins. In the case of books that are dedication copies from the author to friends or colleagues, one can learn about the relationships and common interests that may have prevailed. In this case we learn that Hassler was acquainted with some of the most prominent surveyors and scientists of the time. His education and travel within Europe prior to his coming to the United States allowed him to become acquainted with many of the scientific leaders of Europe. In his biographical notes, Hassler says of his trip to Paris in 1794 [2]:

"I went to Paris, introduced myself to the Astronomer Lalande to Chevalier Borda, Astronomer Delandre and Lavoisier, collected a fine mathematical and diplomatic Library"

Jean-Baptiste-Joseph Delandre and his colleague Pierre-François-André Méchain were at that time involved in the survey of France in order to determine the meter. They were both trained by the Astronomer Joseph-Jêrôme Lalande[9]. These men were the leading astronomers in late 18th century France. Jean-Claude Borda was a naval officer and one of France's most noted experimental physicists. Antoine Lavoisier was one of the most famous chemists of late 18th century France who among other things quantified the nature of chemical reactions. Lavoisier was from a wealthy family and was associated with some commercial endeavors, including that of belonging to the organization that collected taxes, that were in great disfavor by the revolutionaries in France and he suffered the fate of the guillotine in 1794. It was probably occurrences such as this which motivated many people, including perhaps Hassler, to seek a new life in America. Additionally the French Revolution spilled over into Switzerland and the uprisings there and Napoleon's subsequent invasion in 1798 would have caused Hassler considerable consternation and cast a doubt about his continued technical work.

When Hassler came to the new world he had already made the acquaintance of some of the most influential scientists in Europe of his time. His trip to London and France during the War of 1812 allowed him to renew contacts with them and meet new people such as Krusenstern. These relationships gave Hassler a high level audience in Europe to communicate with and share information. His contacts enabled him to know which was the best instrument maker (Troughton) to make his surveying instruments and from whom to obtain accurate measurement standards. This relationship served the United States well as it enabled the early Bureau of Weights and Measures to obtain the best possible standards that were comparable to the best available to European nations. NIST scientists and engineers continue this legacy of providing the nation the best possible metrological tools.

The copy of the Weights and Measures Report that I obtained has had an interesting journey. It went from Washington DC where it was printed, to St. Petersburg, Russia in 1833. This journey took about 7 months and was carried for some part of the trip by the mentioned Baron von Sacken. How it was sent to Pauker is unknown but it was likely by someone carrying it to Mittau as a favor to Krusenstern. The Russian Admiral would not have found it difficult to find someone going by ship to Latvia. There is a library stamp on the title page that is from the library of the Kurland Society for Literature and Art which, as mentioned earlier, Pauker help start [13]. Pauker apparently contributed the book to the library of this society and it became a part of their holdings. It is the usual practice of libraries to occasionally pare their holdings down by selling infrequently used books or ones that no longer seem relevant. This book could have come from such a transaction but it will be difficult ever to tell.

In any event the book has returned home and hopefully can rest peacefully in the NIST historical collection in due course.

9. References

[1] F. Cajori, The Chequered Career of Ferdinand Rudolf Hassler, Three Centuries of Science in America, ed. I. B. Cohen, Arno Press, New York (1980) p. 245.
[2] E. Zschokke, Memoirs of Ferdinand Rudolph Hassler, Printing Office V. Eng Gauthier and Co., Nice (1882).
[3] F. R. Hassler and associates, Weights and Measures Documents, Treasury, Editor. 1832-1845, U.S. Congressional Reports, 22nd-27th congresses.
[4] F. R. Hassler, Comparison of Weights and Measures of Length and Capacity Reported to the Senate of the United States by the Treasury Department in 1832, Treasury, Editor, Duff Green for the U.S. Senate (1832) p. 122.
[5] Encyclopaedia Briannica, The. Eleventh Ed. Vol. 15, The Encyclopaedia Britannica Company, New York (1911).

[6] A. J. Krusenstern, Voyage Round the World in the Years 1803,1804,1805, & 1806, 1 ed. Bibliotheca Australiana, Vol. 38, Amsterdam, N. Israel (1968).
[7] A. McConnell, Instrument Makers to the World: a History of Cooke, Troughton and Simms, York, York (1992) p. 116.
[8] D. Taimina, Mathematics in Latvia Through the Centuries, Cornell University, Ithaca, http://www.math.cornell.edu/~dtaimina/mathinlv.html.
[9] K. Alder, Measure of All Things, First Ed., The Free Press, New York (2002).
[10] D. Sobel, Longitude, Penguin Books, New York (1995).
[11] NOAA, The Hassler Legacy: Ferdinand Rudolph Hassler and the United States Coast Survey, NOAA website, www.lib.noaa.gov/edocs/contents.htm.
[12] J. Munro, Heros of the Telegraph, in WorldWideSchool, The World Wide School, Seattle (1997).
[13] I. Millere, Personal communication, Latvian State Archives, Riga (2005).

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7. Letters from Ferdinand Rudolph Hassler to Admiral Adam J. Von Krusenstern

7.1 Overview

In 2005, as part of his research into his copy of Hassler's *Comparison of Weights and Measures of Length and Capacity* (1832) (see Section 6), Dr. Albert C. Parr contacted the Russian State Archive of the Navy in St. Petersburg to inquire if the Archive held any correspondence between Admiral Krusenstern and Hassler. The fact that the two men corresponded was known because Hassler published three letters written to him by Krusenstern in his *Principal Documents Relating to the Survey of the Coast of the United States since 1816* (1834) (see Bibliography for link to online version). The Archive responded by sending photocopies of seven letters handwritten by Hassler to Krusenstern, from originals in its collection. The first two, dating from 1830 and 1831 respectively, were written in German. The final five, dating between 1833 and 1841, were written in English, perhaps evidence of Hassler's growing confidence with the language of his adopted country.

The English letters are shown here as images produced from the photocopies and with transcriptions prepared by Dr. Parr, Dr. Alfons Weber and Harriet Hassler (all of NIST). Due to the challenges of language, script, handwriting, and poor quality photocopies, transcription of the German letters was very difficult. Dr. Weber partially transcribed and translated the letters into English, but the results were not complete enough for publication. The English letters were also very challenging for many of the same reasons. Legibility was poor due to ink bleeding through the paper of the originals, blotches, and uneven tones of the photocopies. The images provided here were processed through an image editing program to reduce some of these effects. The transcriptions provided here remain incomplete in places. Hassler's spellings and capitalizations have been retained wherever possible, but some punctuation was changed to improve legibility. Most often, this involved changing a comma to a period or semi-colon where a clear beginning of a new thought occurred. Some abbreviations have been provided by the transcriber in fuller form. Despite imperfections with the transcriptions, the editors have chosen to include this material because this valuable primary source material on Hassler has been, to their knowledge, previously unknown and unpublished in this country.

In the letters, Hassler chronicles his struggles with Congress, and his progress with his work on both the Coast Survey and the establishment of standard weights and measures for the United States. From the content it is clear that Hassler provided Krusenstern with copies of his various reports and books written over the years. The letters also include Hassler's exposition on his philosophy for teaching mathematics and training young scholars in the sciences. In the last letter, written in 1841 when he was 70, Hassler states he has finally "won the battle" with Congress, the Navy, and all who waged criticism of his techniques throughout his career. He describes how old enemies have become "friendly supporters," how members of Congress now enjoy visiting his offices and marveling at the work being carried out, and give him no problems at appropriation time. So the letters reveal that Hassler lived out his last years comforted by satisfaction with his accomplishments and contributions to science in the United States government.

7.2 Letter of January 2, 1833

11 July 1833

New York 2d Jan. 1833.

Dear Sir

Already in the Congress of 1829-30. the proposition to renew the Law of 1807. providing for the Survey of the Coast of the Un: St: was renewed. upon a hint in the President's Message and the Statement of the Secretary of the Navy that without the means contemplated by the Law of 1807 these surveys could not be made. The Decision hung on untill last July; in the mean time naval officers formed plans to take the work in their hands, their plans of operation, which I have, but would be too long to communicate, would shew how capable they were for the task. At first the Navy Commissioners seem to have felt well enough the weight of reasons on the side of my plans, to shape their correspondance to Congress upon it, but men thinking themselves up to make extraordinary things by Chronometer's means turned them so that, a so called, Chronometric Survey, was to be substituted, to which they all joined.

In the meantime I had these two Years nearly been engaged in Washington for the Treasury Depart.t, in the Comparison of Weights and Measures of which I join here the report, in a number of Copies to different directions, which Baron Sucken is so kind as take under his charge, with the present, the inscriptions shew their destination (there are 7) I shall be happy if they are satisfactory to the men of science, and be very glad to hear their opinion upon it there is more work in that on hand, and more to be done.

To ensure success to the Navy plans an attempt was made to forestall the decision of Congress upon them, a speech was given to a man, well known as lacking in every capacity required to the task, to descry the trigonometric survey, and substitute a chronometric S: as it appeared in print, though he had not been able to deliver it and stated in relation to me, personally named, that I had worked ten Years and spent two hundred thousand Dollars, and produced so little that Congress in 1818, very properly, abolished it I had to state the truth publicly, the amount of which reduced the ten years to

seven months and 8 days, actual Work, and the 200000 $ to about 13,000 $, all well documented, the Instruments being on hand, or otherwise used, though much spoiled, which is not my fault. My public answer appeared accidentally in the papers the very day when the Law appeared in Congress again, and probably occasioned its passage without a single word being said. When reported to the Senate without amendment, I could easily foresee its passage, and considered it my duty to make a step to save to this country the disgrace of an adoption of the Navy's plans, which I did by informing the Secretary of State, M. Livingston, the only man of scientific information in the Cabinet, of the State of things and the mode of bringing the work in its proper course & style &c. I was just writing for him, "Principal Considerations relating to the Coast Survey," when I was favored with Your second kind letter, speaking again upon the subject, in terms which I found would afford the best proof of my statements, which were besides approved also by M. Nicollet Astronomer of the roy. Observatory of Paris, just setting next to me, then on a visit, he being on a tour through this country. I graciously I enclosed Your letter to M. Livingston in my support, and have never been able since to get it back, it appears to be left at the Presidents. Therein, and in my constant exertions to get it back, lies the cause of the too long delay of this my answer.

The Effect of my step was that the Law was just in the Treasury Depart. for execution, without the Knowledge of the Navy Depart., which then threw petty difficulties in the Way, from the pecuniary side, which I easily settled, with the dispatch they deserved, and began the arrangements and the reconnitering for the work again, as I had done 1816, that is with money that I personally advanced, though this time I was obliged to borrow it from the Un. St. Bank, by friendly help.

Shortly after they could of course not otherwise but send me money after, that covered my expences, and provided further, I have only a few days ago returned from reconoitering, and placing Signals for my next Summer's Stations of the Work, on the east of my former triangulation, besides reviewing my former Stations, where the earthen cones, used for securing the Station points in ground, were well found, after more or less digging, by the indications contained in the Journal Kept at the time to that effect.

So has the work of this Survey again in activity, and nothing shall be spared, on my side, to carry it on in an honorable manner, satisfactory to men of science, with as much celerity as the nature of the work admits, and as long as my life, or the confidence of this Government to me may last. I shall make it an object of satisfaction to me in the work, to give You from time to time a short account of my doings if they can be of any interest for You. I do not doubt but that I will have still some experiences to make, in addition to those I made the former time, in respect to, what may be called, the moral conduct of the business, for I am already informed of the activity put by the Navy in working their plan in opposition to mine, but I mean to let as much of that all pass unminded, as is ever possible. If, as it appears, they will not believe that, though they improved in their nautical affairs here, since my former work, they have not done so in this branch of it, the experience will be their only teacher.

Your approbation of my tables and desire to introduce their use in Your navy, was an object of the greatest satisfaction to me I have therefore since revised them entirely through and corrected the few errors they had yet, though generally of such a nature that no calculator a little practised could be led me error by it, being generally in the repeated standing first figures I have also further negotiated with editor Hassler about the lowest

price at which they could furnish them by the quantity. As the binding is the part which proportionally increases the price the most in this country and which You may likely obtain cheaper & better in Your neighbourhood besides that the bulk increases the transport, it was thought best to state the price in sheets Collated so as to be ready for binding and be sure to be compleat; they have set the price at $\frac{9}{10}$ of a Dollar per Copy in that state provided 1000 or at least 500. Copies are taken, I therefore am authorised to propose You this and if You will please to favor me with an assenting answer I shall care the immediate providing of them.

You know the different languages in which the introduction is printed and of which one only is allways added according to the desire of the purchaser You will therefore oblige me by stating in which language You will wish it or how many copies in the different languages if of several languages

As for a call from Mexico for a number of Copies there is now a new edition to be printed, corrected as I stated, You would also get the copies made on purpose for You of the Corrected edition. I shall be extreemly glad if this modification of arrangement and price can procure the commission which You intended to give of a thousand Copies & I will in case take care that Your orders be well executed.

Among the Copies of my Rapport on W & M: is one for my old University friend Mr Bartels in Dorpat to whom I have repeatedly written & got but one answer a long time ago, as these places Kön: & D: lie both near You I take the Liberty thus to intrude upon Your Kindness for their delivery.

I shall be very happy if You will continue to favor me with letters & hope in future to be quicker in answering when the first bustle of setting my work in activity will have settled in a regular train of Work.

With best wishes for Your happiness I remain

Your obt Sr

F: R: Hassler

Admiral Krusenstern
&c &c
St Petersburg

Transcription

[Margin annotation: 11 July 1833 (date received or answered)]

New York, 2 [January] 1833

Dear Sir

Already in the Congress of 1829-30 the proposition to renew the law of 1807 providing for the Survey of the Coast of the Un. St. [i.e., United States] was renewed upon a hint in the President's Message and the Statement of the Secretary of the Navy that without the means contemplated by the law of 1807 these surveys could not be made. The Decision hung on until last July; in the mean time naval officers formed plans to take the work in their hands, their plans of operation, which I have, but would be too long to communicate, would show how capable they were for the task. At first the Navy Commissioners seem to have felt well enough the weight of reasons on the side of my plans to shape their correspondance [*sic*] to Congress upon it; but men thinking themselves up to make extraordinary things by chronometer's means turned them so that a so called "Chronometric Survey" was to be substituted, to which they all joined.

In the meantime I had these two years nearly been engaged in Washington for the Treasury [Department], in the comparison of Weights and Measures of which I join here the report, in a number of copies to different directions, which Baron Sacken is so kind as to take under his charge, with the present, the inscriptions show their destination (there are 7). I shall be happy if they are satisfactory to the men of science, and be very glad to hear their opinion upon it, there is more work in that on hand, and more to be done.

To ensure success to the Navy plans an attempt was made to forestall the decision of Congress upon them, a speech was given to a man, well known as lacking in every capacity required to the task, to descry the trigonometric survey, and substitute a "chronometric" [Survey] as it appeared in print, though he had not been able to deliver it and stated in relation to me, personally named, that I had worked ten years and spent two hundred thousand Dollars and produced so little that Congress in 1818 "very properly" abolished it. I had to state the truth publicly, the amount of which reduced the ten years to

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seven months and 8 days, actual work, and the 200,000$ to about 13,000$, all well documented, the instruments being on hand, or otherwise used, though much spoiled, which is not my fault. My public answer appeared accidentally in the papers the very day when the Law appeared in Congress again, and probably occasioned its passage without a single word being said. When reported to the Senate, without amendment, I could easily foresee its passage, and considered it my duty to make a step to save to this country the disgrace of an adoption of the Navy's plans which I did by informing the Secretary of State, Mr. Livingston, the only man of Scientific information in the Cabinet, of the state of things and the mode of bringing the work in its proper course & style &c. I was just writing for him "Principal Considerations relating to the Coast Survey" when I was favored with your second kind letter, speaking again upon that subject, in terms which I found would afford the best proof of my statements, which were besides approved also by Mr. Nicollet, Astronomer of the [Royal] Observatory of Paris, just setting next to me, then on a visit, he being on a turn through this country. Incautiously I enclosed your letter to Mr. Livingston in my support and have never been able since to get it back; it appears to be left at the President's. Therein and in my constant exertions to get it back, lies the cause of the too long delay of this my answer.

The effect of my step was that the Law was put in the Treasury [Department] for execution, without the knowledge of the Navy [Department], which then threw petty difficulties in the way, from the pecuniary side, which I vainquished [*sic*] with the dispise [*sic*] they deserved, and began the arrangements and the reconnoitering for the work again, as I had done in 1816, that is with money that I personally advanced, though this time I was obliged to borrow it from the Un. St. [i.e., United States] Bank by friendly help.

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Shortly after, they could of course not otherwise but send me money after, that covered my expenses, and provided further; I have only a few days ago returned from reconnoitering and placing signals for my next summer's stations of the work, on the east of my former triangulation, besides reviving my former stations, where the earthen cones, used for securing the station points underground, were well found, after more or less digging, by the indications contained in the journal kept at the time to that effect.

So far the work of this Survey is again in activity, and nothing shall be spared, on my side, to carry it on in an honorable manner, satisfactory to men of science, with as much celerity as the nature of the work admits, and as long as my life, or the confidence of the Government to me may last.

I shall make it an object of satisfaction to me in the work, to give to you from time to time a short account of my doings if they can be of any interest for you. I do not doubt but that I will have still some experiences to make, in addition to those I made the former time, in respect to what may be called the moral conduct of the business, for I am already informed of the activity put by the Navy in working their plan in opposition to mine, but I mean to let as much of that all pass unminded, as is ever possible. If, as it appears, they will not believe that, though they improved in their naval affairs here since my former work, they have not done so in this branch of it, the experience will be their only teacher.

Your approbation of my tables [i.e., Hassler's *Logarithmic and Trigonometric Tables*] and desire to introduce their use in your navy was a subject of the greatest satisfaction to me. I have therefore since revised them entirely through and corrected the few errors they had yet, though generally of such a nature that no calculator a little practised [*sic*] could be led in error by it, being generally in the repeated standing first figures. I have also further negotiated with the editors Mess. Carvill about the lowest

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price at which they could furnish them by the quantity. As the binding is the part which proportionally increases the price the most in this country and which you may likely obtain cheaper & better in your neighbourhood besides that the bulk increases the transport, it was thought best to state the price in sheets collated so as to be ready for binding and be sure to be compleat [*sic*]; they have set the price of 9/10 of a Dollar per copy in that state, provided 1000 or at least 500 copies are taken. I therefore am authorized to propose you this and if you will please to favor me with an assenting answer, I shall care the immediate providing of them.

You know the different languages in which the introduction is printed and of which one only is always added according to the desire of the purchaser. You will therefore oblige me by stating in which language you will wish it or how many copies in the different languages if of several languages. As for a call from Mexico for a number of copies there is a now a new edition to be printed, corrected as I stated, you would also get the copies made on purpose for you of the corrected edition. I shall be extremely glad if this modification and arrangement and price can procure the commission of which you intended to give of a thousand copies & I will in case take care that your orders be well executed.

Among the copies of my report on W. & M. [i.e., Weights & Measures] is one for my old University friend Mr. Bartels in Dorpat to whom I have repeatedly written & got but one answer a long time ago; as these places [Königsberg] & [Dorpat] lie both near you, I take the liberty thus to intrude upon your kindness for their delivery.

I shall be very happy if you will continue to favor me with letters & hope in future to be quicker in answering when the [first?] bustle of getting my work in activity will have settled in a regular train of work.

With best wishes for your happiness
I remain your [obedient servant]
F.R. Hassler

Admiral Krusenstern
&c &c St Petersburg

7.3 Letter of April 6, 1838

Washington - City 6th April 1838

My Dear Sir

To take advantage of Captain Von Schanz to call myself to
your recollection, I take the Liberty to trouble you with the present
The acquaintance of HVV: Sch, and his company, while he was in this
place, has been a source of much pleasure to me, Our acquain-
tance will enable him to give you verbal informations upon
me more than a letter, I therefore refer to it in a great measure.
I do not know whether the whole of the Documents, which
I was obliged to print upon my works, as defense against the
spirit which you know opposed it constantly, are in your hands;
though I forwarded several Copies to you, at any rate C: V: Sch:
has them again, together with several Copies of my last report,
which is but short, but refers besides the C: S: to my manner of
establishing the System of Mint Weights, in ounces as Unit,
from the 12 oz Troy Pound. You will find the method
of combinatory weighing, which I employed, like I had done with
the Metres a bout, new, and successfully adapted to the case.
I continue to apply it now to the greater Weights, which I
am just now engaged in adjusting for each State and Territory
of this Union one set, and which I expect to deliver to Govern-
ment about in July, untill when it is likely that Congress will
set & then have the satisfaction to receive them as a Viaticum
To accelerate the works we have constructed Balances with
Metal Beams up to over 4 feet in length, & I think the satis-
faction of seeing them so successfull as to give with 50 lb Ad Pond
in each Bassin the accuracy of 0,1 of a grain is to be considered
as a reward for their good contrivance, and the good skillfull work
of the workmen of my establishment, the combined weighings do
even not shew half so much in the extreem difference of the results, at least
now while the balances are new.

The new 30 inch Dr Theodolite received of Simms, and the use of the heliotropes will add a great improvement and more celerity to my work. as has been proved by last Summers work. Mr Simms says of the instrument it is the largest in the Vertical Circle (2 feet) which they ever made; and the last work in which Mr Troughton took an active share. I have constructed in my own Mecanicians Shop here a stand with smaller horizontal Circle and a long vertical Axis to mount it separate in order to use it for time simultaneous with the horizontal Circle furnished with a simple transit for the terrestrical angles, in observing Azimuths &c. I ordered from Munich 4 such telescopes which Mr Schumacher in Altona was so kind to procure, I received lately, by which I contemplate the further improvement of applying one of the Object glasses of them to the 12 inch (english) telescopes of the Instrument, which trials shew me will fully succeed, and then I hope to have the fullest & best Instrument ever brought in the field as far as I can contrive it. Straight signals rendered in their proper time of illumination the former partly of the Heliotrope, the permanency of the latter is of great advantage that the celerity in collecting Objects is 3 fold certainly. they penetrate even a bad foggy atmosphere, as on our shore so frequent tho' of course with a disagreable irradiation.

I take the Liberty to mention to You these details, as an addition to collecting Data, that may find application and Parallels in the northern Surveys going on in Russia.

I contemplate to prepare to determine, between 2° and 3° of Longitude passing over Long Island Sound &c leaving but a proportionably small variation in Latitude, 2. Years work about may be considered as lieing yet between the present state of the work, and the possible execution of this plan; it must namely be considered that I must every Year furnish, or rather only shew the proper quantum of detailed Maps & Charts, besides adjusted Weights or Measures; by I will hope that I have now Conquered the good opinion & will of Congress which the Executive Powers must respect, and thereby prevent that the present bad financial state be used as an excuse to destroy the work.

I shall be very much pleased to hear of, and in time see the Result of your Surveys towards the Pole, and of the Leveling between the Caspian and the Black Sea where I find a method is employed which I thought might in an extreem case even be employed on wooded & difficult triangulating Coasts.

Relying, as said above upon Capt. V. Schenz to tell you of my situation and work what might interest you I take the Liberty only yet to request you will remember me friendly to Mr Struve and whatever friend who may be so kind to keep remembrance of me,

With best wishes & perfect respect

Yours affectly
F. R. Hassler

I should like yet to suggest that the new Observatory building near you should be surrounded as I projected by a ditch, should it be only 2 - 3 feet deep it suffices to take away what I would like to call the musical tramours of the ground which certainly otherwise every Carriage coming near the Observatory will occasion; the proof has been administred here on a minute scale.

Transcription

Washington City, 6th April 1838

My Dear Sir,

To take advantage of Captain Von Schanz to call myself to your recollection I take the liberty to trouble you with the present.

The acquaintance of Mr. V. Sch. [i.e., Von Schanz], and his company while he was in this place, has been a source of much pleasure to me. Our acquaintance will enable him to give you verbal information upon me more than a letter, I therefore refer to it in a great measure.

I do not know whether the whole of the Documents which I was obliged to print upon my work, as defense against the spirit which you know opposed it constantly, are in your hands, though I forwarded several copies to you, at any rate C. V. Sch. [i.e., Captain von Schanz] has them again, together with several copies of my last report, which is but short, but refers besides the C.S. [i.e., Coast Survey] to my manner of establishing the system of Mint Weights, in ounces as Unit, from the 12 oz Troy Pound. You will find the method of combinatory weighing, which I employed, like I had done with the Metre, in [bout?], new, and successfully adapted to the case. I continue to apply it now to the greater Weights, which I am just now engaged in adjusting, for each State and Territory of this Union one set, and which I expect to deliver to Government about in July, untill [*sic*] when it is likely that Congress will set & then have the satisfaction to receive them as a Viaticum. To accelerate the work we have constructed Balances with Metal Beams up to over 4 feet in length, & I think the satisfaction of seeing them so successful as to give with 50 lb A d Poid [i.e., Avoir du Poid] in each bassin the accuracy of 0.1 of a grain is to be considered as a reward for their good contrivance, and the good skillful work of the workmen of my establishment, the combined weighings do even not shew [sic] half so much in the extreem [*sic*] difference of the results, at least now while the balances are new.

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I shall be very much pleased to hear of and in time see the result of your Surveys toward the Pole, and of the Leveling between the Caspian and the Black Sea where I find a method is employed which I thought might in an extreem [*sic*] case even be employed on wooded & difficult triangulating Coasts.

Relying, as said above upon Capt. V. Schanz to tell you of my situation and works what might interest you I take the liberty only yet to request you will remember me friendly to Mr. Struve and whatever friend who may be so kind to keep remembrance of me.

With best wishes and perfect respect
Yours [affectionately]
F. R. Hassler

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7.4 Letter of October 28, 1838

Springfield New Jersey 28th October 1838.

My Dear Sir

The Station of the Coast Survey upon Woosel Mountain, and which was my first in the earlier Coast Survey 1817; and which I left so recently, in continuance of my works so entirely, has been a place of great gratification to me this time, by the reception of Your very kind letter of the 20th July, in which You desire my Ideas upon a subject which I shall treat with pleasure, as well as I am able, so much the rather as in various respects so many Ideas have a great tendancy to my own, and I have already twice in this country tried to give more principled Ideas, upon the establishment of the military Academy (the only thing of the Kind) and an intended naval Academy which was never even mentioned after, both being now very much at a random In the introductions to my elementary works of Mathematics I had intended to give the (in my opinion) fundamental Ideas upon the study & nature of same as to give to the mind the mathematical direction, to make the Sciences the own of the learner, which is so often found not to be the case, even men who have even devoted much time to it, learning detached questions to recite them from memory, like Cathechising, which they have unfortunately been led through in the earliest instruction. In my Arithmetic and Geometry I tried: some of these Ideas have been introduced, but I intended to complete this publication further, by that to my Elements of mathematical Analysis, which has remained half finished (the fully sketched) manuscript, by the circumstance of my being again engaged in the practical parts, which have hitherto absorbed all my time. A similar introduction I have made to an elementary Course of lectures upon natural philosophy, which I lectured in Schenectady College to satisfaction.

As I believe my Arithmetic and Geometry in your hand, I will take the Liberty to suppose them here inserted, and when I come to my MS: I will have a Copy made of that of the analysis to send it to You. In the Analysis I was always displeased to find under the name of Algebra (in the english particularly) a mere collection of some Kind of Receipts to solve curious, and sadly seldom practically usefull questions, and no continued thread of the science from its first Idea and elements to its high and usefull results, to which the Scholar might

Your ambassador with whom I have made acquaintance, and shewed him my establishment there. &c &c.

I will besides try to make some little compensation to You, by sending You results of my works before even I give them to Congress my reports and a map which will shew to You the new Channel into New York for which my assistant, who sounded it, received a set of Silver plates, & I who told him that he should find it, & furnished him with the accurate points to be able to ascertain it, got the honor to be called his very able assistant, in the news papers, which, at least in this Country, must "ex officio" present every thing upside down. I shall have to put it close to the Ambassador, if he will take charge of it accurately, or then rather trust it to Mess Good here in N: Y: & to the direction which You are so good as to indicate to me, to these also You can safely direct the book of Your son, which You was so kind as to promise to me, and any thing else.

You will I hope have received last summer various things from me by Captain Von Schantz, of Your Navy, whom I had the pleasure to know in Washington (from Finland) whom please present with my friendly recollections; & who can tell You "viva voce" of me & what he sees of my doings. You may judge thence that I never meant to send anything but single letters by post but that things fall into it against my arrangement, a 3d Case happened to me with Mr Zandt counsellor at the Court of Baden.

By Mr Von Schantz You shall, or have by this time, received, my last report of the Coast Survey, & the Construction of the Weights for the Mints, where I had to make a System of ounce weights in Decimals up & down, out of the 12.oz Troy pound. You will oblige me by communicating to Mr Prucker the new System of Combined weighing, which I applied there, I think successfully, & let me know his opinion upon it. I have applied it again since, and have delivered for each State & territory of this — Union — a set of Standard Weights. My report upon this and that now just sent in, for the near opening of Congress, which I shall add, will then inform You more

of what I am about in these scientifically hyperborean regions. I should like to send a full copy of all my Coast Survey & Weight & measure works and troubles, to be deposited as historical Documents in the Library of Your imperial Academy of Sciences, without other pretensions than as a mixt of facts in the history of science, as all such histories have always some parts that are instructive upon the manner in which good can be done in the world, with the only power of sound honest arrangement appropriated to the ground & climate in which the seed is to be made to render results

I must yet state to You one fact. As You see Your last letter came the first and the first the last: Of the former I have taken great advantage shortly after its arrival last month. One of my assistants was accused in the Treasury Dept to speak politics (that is here electioneering) & accounts asked of me to trip culp him by facts. I answered to the Dept that I sent him the letter & did otherwise not mix in the actions of my assistants in anything except the Survey adding that I had received a letter from You upon Mathematical Instruction in public seminaries, which I would communicate of Copy of; as the Sec^y of Messrs had received of me upon ball when he first entered the Ad ministration, as Sec^y of the Navy, a plan (as above) for a naval Academy. When I received the Answer from my assistant I made the sending of this copy the main object of my letter and treating the other part as a trifling accessory which it was not proper to lay any weight upon I (as it appears) stopped the spring out of which this (otherwise long sought for) intrusion had come entirely for all is silent since. So You see how Your letters are always of great service to me, I am very sorry to have lost the one received just at the moment of the revival of the Survey by communicating it in original to the President Jackson, whence I never got it back, but it made its good effect

I will now for this moment end, so near the end of my paper and continue to bring together the means of a fair answer as well as I can to Your kind and interesting question. Wishing You all health and happiness & recomanding me in Your kind friendship

Yours aff^ty F: R: Hassler

Admiral Kreusenstern Russian Navy
Petersburg.

Transcription

Springfield, New Jersey, 28th October 28 1838

My dear Sir,

The station of the Coast Survey upon Weasel Mountain which was my first in the earlier Coast Survey of 1817, and which I just now left in continuance of my work southerly, has been a place of gratification to me this time, by the reception of your very kind letter of the 20th July, in which you desire my ideas upon a subject which I shall treat with pleasure, as well as I am able, so much the rather as in many various aspects I see your ideas have a great tendency to my own, and I have already twice in this country tried to give more principled ideas, upon the establishment of the military academy (the only thing of the kind) and an intended naval academy which was never even mentioned after, both being now very much at a random. In the Introductions to my elementary works of mathematics I had intended to give the (in my opinion) fundamental ideas upon the study & nature of process to give to the mind the mathematical direction, to make the science the own of the learner, which is so often found not to be the case, with men who have even devoted much time to it, learning detached questions to recite them from in memory, like cathechising, which they have unfortunately been led through in the earliest instruction. In my Arithmetic and Geometry Introd. [i.e., Introduction] some of these ideas have been introduced, but I intended to complete their publication further, by that to my Elements of Mathematical Analysis, which has remained half finished (tho' fully sketched) in manuscript, by the circumstance of my being again engaged in the practical parts, which have hitherto absorbed all my time. A similar Introduction I have made to an elementary course of lectures upon natural philosophy, upon which I lectured in Schenectady College to satisfaction.

As I believe my Arithmetic and Geometry in your hand, I will take the liberty to suppose them here inserted, and when I come to my M.S. [i.e., manuscript] I will have a copy made of that of the Analysis to send it to you. In the Analysis I was always displeased to find under the name of Algebra (in the english particularly) a mere collection of some Kind of Recipes to solve curious, and only seldom practically usefull [*sic*] questions, and no continued thread of the science from its first idea and elements to its high and usefull [*sic*] results, to which the scholar might

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hold himself in the pursuit of his aim (the science) and avoid the temptation to step aside to the numerous accessories, which occurr [*sic*] on every step to lead him off. If the system of the science is properly built out of its own means, gradually, as they develop themselves , the scholar makes this system of [corrected?] ideas his own and deduces from it, in his own way, not only the solution of any such questions, or deduction of consequences, but even the different turns of genius occasion the variety in method & systems, and abridging habits, according to the different turn of mind and genius of the individual; this the history of the science proves, and I have on various occasions, in my practical teaching, before and since I wrote elementary works made the practical prove of it in full.

Perth Amboy, N.J., 27th November 1838

This evening by candle light in this dying off village, where my store for the Coast Survey Instruments is, in which I just direct a move, at my breaking up of the campaign, I have the redoubling of the high satisfaction of receiving your very friendly letter of the 13t June. Your liberality to take up the packet of my Coast Survey Documents, letter, etc., at the high expense it was put at to you deserves my greatest thanks; that it was not intended so, you certainly judge, but that is the second time that by means of your ambassadors, or their couriers rather, the circumstance occurs to my sending, once by a courier of our friend, Baron [Kriedener?], who had been directed by him to give a package containing a long and for me important letter, & copies of all my books & directed to Dr. Tiarks, the british astronomer, in that Boundary line with Canada there my contrepart, containing

objects for the Royal Society of London, & friends, &c being ordered by B.K. [i.e., Baron Kriedener] to be given off at London directly, was put on board of the ship already in the letter bag, & by the Ports from Liverpool to London being rated at 18 & some fraction of Pound sterling was refused, as habitual in London, probably burnt, & since my connections complained of not receiving my communications, notwithstanding I tried the remedy, &c.

Now I will try send this letter by Mess. Goodhue in New York who [have the house there?], best in the russian Commerce, & my friends, to forward this letter, when I go tomorrow to New York, and in advance of what I said in the above of my intentions, which I will then execute this winter in Washington as soon as I can (for my difficulties in work are still considerable) and give it to

[end of second page]

your Ambassador with whom I have made acquaintance, and shewed [sic] him my establishment there. &c. &c.

I will besides try to make some compensation to you, by sending you results of my works before even I give them to Congress my reports and a map which will show to you the new channel into New York for which my assistant, who sounded it, received a set of silver plate, & I who told him that he should find it, & furnished him with the accurate points to be able to ascertain it, got the honor to be called his very able assistant, in the news papers, which, at least in this country, might "ex officio" present every thing upside down.

I shall have put it close to the Ambassador if he will take charge of it accurately, or then rather trust it to Mess. Goodhue in N.Y. & to the direction which you are so good as to indicate to me, to these also you can safely direct the book of your son, which you was so kind as to promise to me and anything else.

You will I hope have received last summer various things from me by Captain Von Schantz [i.e., Schanz] of your Navy, whom I had the pleasure to know in Washington (from Finland) whom please present with my friendly recollections, & who can tell you, "viva voce" of me, & what he has seen of my doings. You may judge then that I never meant to send anything but single letters by post but that things fall into it against my arrangement, a 3d case happened to me with Mr. Zandt counsellor [*sic*] at the Court of Baden.

By Mr. Von Schantz [sic] you shall, or have by this time, received, my last Report of the Coast Survey & the Construction of the Weights for the Mints, where I had to make a system of ounce weights in Decimals up & down, out of the 12 oz Troy pound. You will oblige me by communicating to Mr. Pauker the new System of Combined weighing, which I applied there, I think successfully, & let me know his opinion upon it. I have applied it again since, and have delivered for each State & Territory of this Union a set of Standard Weights. My report upon this and that now just sent in, for the new oppening [*sic*] of Congress, which I shall add, will inform you more

[end of third page]

of what I am about in these scientifically hyperborean regions: I should like to send a full copy of all my Coast Survey & Weight & Measure works and troubles, to be deposited as historical documents in the library of your Imperial Academy of Sciences, without other pretensions than as a [weighting?] of facts in the history of science, as all such histories have always some parts that are instructif [*sic*] upon the manner in which good can be done in the world, with the only power of sound honest arrangement appropriated to the ground & climate in which the seed is to be made to render results.

I must yet state to you one fact. As you see your last letter came the first and the first the last. Of the former I have taken great advantage shortly after its arrival last month. One of my assistants was accused in the Treasury Dept. to speak politics (that is here electioneering) & accounts asked of me to [exculp?] him by facts. I answered to the Dept. that I sent him the letter and did otherwise not mix in the actions of my assistants in anything except the Survey, adding that I had received a letter from you upon Mathematical Instruction and public seminaries which I would communicate a copy of, as the [Secretary of the Treasury] had received of me upon [all?] when he first entered the old administration as Secretary of the Navy, a plan (as above) for a naval Academy. When I received the answer from my assistant I made the sending of this copy the main object of my letter and treating the other part as a trifling accessory which it was not proper to lay any weight upon. I (as it appears) stopped this spring out of which this (otherwise long fought for) intrusion had come entirely for all is silent since.

So you see how your letters are always of great service to me. I am very sorry to have lost the one received just at the moment of the revival of the Survey by communicating it in original to the President Jackson, whence I never got it back, but it made its good effect.

I will now and for this moment end, so near the end of my paper and continue to bring together the means of a fair answer, as well as I can to your kind and interesting question. Wishing you all health and happiness & recomanding [*sic*] me in your kind friendship

Yours [affectionately] F: R: Hassler

Admiral Krusenstern
Russian Navy
Petersburg

7.5 Letter of May 18, 1839

Ft: Admiral Krusenstern
at St Petersburg Russia

Washington City 18th May 1839.

My dear Sir

Your two so very friendly and agreable letters of 13 June & 20th July a: p: gave me the greatest pleasure last September when they met me at one of the principal stations of the Coast Survey. I was not yet fully recovered from a sickness of more than a month, & very much engaged in determining Azimuths, Latitudes, terrestrial angles, and observing the solar eclipse so I was prevented in answer immediately, as my desire would have been. On coming again here, into Winter quarters, I begun a letter for You, & undertook to do something towards solving the task which You gave me upon the principles of mathematical instruction but press of business distracted me again from it, & ultimately now I cannot find the letter itself, which I had begun two months ago. I returned again to the task but called of unexpectedly, its ultimate finishing has delayed untill now.

I join here, and shall shew to Mr Bodisco, Your ambassador here the package which I intend for You, asking his advise, or action, upon the manner of sending it. Mr Kremer, attach: to the Legation, promised me also to forward safely to You any thing I should give to him. It appears that I am unfortunate in the forwarding, as I occasion to my friends large expenses against my will, notwithstanding all I try, a case like Yours happened to me in England, where even 18 £ were charged, the package refused, & the books, Reports, letters &c, all burnt, notwithstanding a russian Courier had been ordered to deliver it in London himself, instead of, as he did, throw it in the Letter bag, on board the Liverpool packet. &c

This delay in time, I intend to compensate to You by the collection which I have made during the time, of a number of Documents, and Maps, which may probably be agreable to You, so I shall make out of all, one somewhat thicker letter package, one of printed Documents, and one a roll of Maps, among which two bad extracts from the Coast Survey called for by Congress, & executed, "à la diable," by their engraver. I hope the whole will not cost you as much as before, though it may be worth for You at a distance, like I consider as valuable similar things that come from a friend, notwithstanding I claim no special merit in this case.

I join of course my last reports giving you account of my doings, I add to it, that since the last I have delivered the whole of the over 100 sets† of Standard Weights for the custom houses, each of 10 pieces, between 1 lb & 50 lb. The Yards are under final adjustment, the Gallons ready for adjustment, the half Bushels in casting. The Coast Survey extends now over more than 3,000 square miles engl: in all the topographical details, the triangulation from 60. – 100 miles farther east & south. I shall take Measures to have the part, comprehending the port of NewYork, put under finishing drawing, & engraving, but I am somewhat embarrassed to get good Copper plates; the english, which would be the easiest obtained here, I distrust on account of the Iron always contained in the english Copper, the hungarian copper I consider the best in quality, but where are there printing plates made of it? that I do not know.

Since last fall I have also made considerable advances in the organisation and proper lodging of my works, in 3 houses joined, affording forty & odd rooms all occupied alternately, or together, according to circumstances, by Geometers, brass workers, mathematical Instrument makers, casting establishment &c &c and assistants. I have plenty of different weight, applications too thick, like blackberries

† many in all, the number of sets "150."

You call upon me for a statement of my views upon the principles of teaching mathematics ~~was~~ agreeable to me. I conceived immediately the plan upon which to treat it, but the delay, from then to the execution has I believe not been advantageous to the best finish of the treatment of the subject, because I could not devote to it all consecutive time. Already in Switzerland, as member of the Council of Education, I made a plan for our Schools preparatory, & for elementary sciences, which worked very well & was much approved by men of science. When I became, in this country, Professor of Mathematics to the military academy, I made one for that institution, which was again approved, but not fully executed in the present establishment. Of these two I have no Copies, but having only lately been called upon to give my Ideas upon the form of disposing of the Smithsonian legacy, for an institution of instruction here, I can join here a copy of it. I have on various other minor occasions made similar plans, but what success they had I would not know because of my moving off.

I may probably clear up my Ideas in some respect, by adding here Copies of my manuscript introduction to an analysis, which I was just writing, when I was again called in activity by the Government, and that of the natural Philosophy begun to write for my Lectures in that Branch, as Professor at Union College, in Schenectady, in 1810. In this latter You find entirely new principles upon the 1st Elements, I think the bringing into an analytical formula the relations between Gravity & Cohesion. Le is lucid & solving difficulties in these elementary reasonings, which appear rather to have been turned around their mat,

I have threatened to present more the principles of reasoning [illegible], or (Ars philosophandi) and the ratio [illegible] [illegible], by the fully mathematical introductions of the time, as prototypes of all motions; I should have liked to publish this introduction, but having not the time to file out the whole work, of which a certain quantity is in M.S. I have not found a place proper to put it in the public.

In the papers I send to you here, upon your question, you will find that I have longer dwelt upon the elementary part than upon the higher branches, because I think this part the most essential to be organised in a more scientific form, than is habitual, and that by this neglect scholars are very much retarded, & many wrong ideas admitted; I wish therefore also that they shall be thought in their first principles by the same Professors, who being masters of the higher branches, know how to treat these elements by the [illegible] road up to their higher branches, this I requested already in my school plan in Switzerland, and with full good success, in more extensive institutions the Professors will be much relieved by the introduction of what I have called repetitors, so that they can keep the closer to the essential principles of the science as [illegible]

In the higher Branches there is then no more need to proceed so strictly upon prescriptions, because the greater means acquired by the scholar ease the task of the Professor, and that it is of much more advantage, if he has been the man, who has given them the first elements, can therefore quote himself always in one continued system, and knows upon what previous knowledge of his scholars he can ground his higher instruction. Besides then at these points of progress of studies the different minds & capacities have

already taken a special more independant course, and deciding upon the future aim of their studies, are perhaps already distributed in special practical schools, organised to give the means to (bring) themselves forwards in their individual turn & propensity. These higher branches, therefore in some measure order and discipline themselves, I have discovered by my introduction of the reasoning upon cause, time, and effect, expressed arithmetically, when I was teaching it to boys of 12. Years, long before the printing, that these kind of reflections are very readily taken by the Scholars, and they worked upon it with peculiar satisfaction, & were gratified by finding themselves above their examiners who had never come to so high a reflection for arithmetic, they solved by their means, & the reductions of the terms of the proportions to their smallest ultimate calculating numbers, questions which I know at that time not a single Engineer officer in this country could solve.

Having encroached upon you so far as to give extracts of older writing of mine, I will yet add an improvement in one. In my analytical trigonometry pag 72. I have given a general ~~form~~ series for the tangents, without division which is entirely new and unique in form compared with the other series of trigon: functions; Cagnoli yet said (dans les tangentes on n'est pas encore arrivé a eviter la division, this induced me to the investigation which proved successfull. But in the page 72 as printed I have not yet selected the best form of presenting the binomial factors which enter of course in the series. I have since taken up the subject again. & present you here the bettered statement of whole. thus, after the 7.th line call the successive binomial coefficients n; n_1; n_2; n_3 &c. that is $n = n$; $n_1 = \frac{n(n-1)}{1.2}$; $n_2 = \frac{n(n-1)(n-2)}{2.3}$; $n_3 = \frac{n(n-1)(n-2)(n-3)}{2.3.4}$ &c. Then will the series be represented in the following form, (the 1st term being denoted by A. the 2d by B & so on for all subsequent terms &c)

$$\tan^{n} na = \tan a + (n_1 A - n_2)\tan^3 a + (n_1 B - n_3 A + n_4)\tan^5 a +$$

$$+ (n_1 C - n_3 B + n_5 A - n_6)\tan^7 a + (n_1 D - n_3 C + n_5 B - n_7 A + n_8)\tan^9 a$$

$$+ (n_1 E - n_3 D + n_5 C - n_7 B + n_9 A - n_{10})\tan^{11} a + \&c.$$

(Above the brackets: A, B, C, D, E, F)

After the last phrase of the page is yet to be added

" The general term may be easily deduced from the preceding; under the same denominations &c. calling the last term to be taken in the series by Z, and so retrograding; it will be as follows. –

$$\text{term } p \text{ of } \tan na = \left(n_1 Z - n_3 Y + n_5 X + \&c + \&c \pm n_{(2p-5)} B \mp n_{(2p-3)} A \pm n_{(2p-1)}\right)\tan^{(2p-1)} a$$

The upper signs being for p = an even number, the lower for p = an odd number.

As this has first appeared in an elementary work in which men of higher science had deigned to look, (to often) it has remained unobserved hitherto

You know well that the occasion for my work of the survey of the Coast, was to get an accurate map, you are certainly equally aware that the Idea of making first an accurate full triangulation over the whole, like in Europe, was inadmissible heree, the insight into the principles of such a work did not exist, but in very few persons. I had therefore already in 17. brought the part of the work, which I had been able to make in a few months (as to serve in such a state) as to secure for geographical purposes only, with sufficient accuracy (in a small district), still seeing no maps, Congress could be misled in my absence to destroy it and the saying "I am sorry" did not mend it.

as I said to our present President, when he told me, he would rather not
have the work than I must trouble, because he had to approve a resolu-
tion of Congress against his will.

I have therefore at the 2d begining of the work equally made haste
to, what is called in this Country, shew them something for their money
and pushed the topographical works immediately after the measurement
of the new base line,[1] of which I believe I gave you account, grounding
in Latitude and Azimuth preliminarily upon the 1st Years
result, made with somewhat imperfect means. After the [illegible]
[illegible] Observations of last Year the Calculations were all renewed
for the Triangles, all observations for Lat. & Az: from different
Stations reduced anew to one; the results differed in Latitude 0,"3
and in Azimuth less than 2". this I consider as satisfactory enough
to allow to print even Maps, which is now the Desideratum of
all interested in the work, which I must try to satisfy, to avoid
letting this part of the work fall in the hands of jobbers, by
perhaps some side influence in Congress.

It is natural that I should like when I come near here to
be able to join my work to an observatory well appropriated,
this has in a great measure been spoiled by my own good willing-
ness to assist before and even just when the C. S. began again, to
assist Lieut Wilkes, now in the South Sea Expedition, to erect
one of the transit Instruments of the Coast Survey, which I lent
to him at the very first where I had intended in 1816 to build one
under a mere wooden shelter, though upon stone pillars, as he
had means to purchase the ground, house, &c which I had not,
nor could then propose, on account of the positive prohibition of
the C. S. Law, that was inserted [illegible] by the instigation against me [illegible])

(1) and the second [illegible] of 1833.

the Arrangement, which You have probably seen in the Documents that I was able to print, is unfortunately not a sufficiently scarce example of — [illegible]. I must still continue some Years upon my same plan, by which I shall get several parts of accurately determined Lat. & Long: Degrees that it will be possible to [illegible] afterwards scientifically.

the present Secr.y of War proposes much the survey of the Northern Lakes, which I try to favour, that work could be joined to mine and we could get extensive Data still, a Meridian from New York City to Montreal would be easy & fine, &c.

I can not here state to You what I find in the two other packages in Detail because it is the result of all that I could gather [illegible] that I think might at least You gradually put together; with this You will find several of my former writings upon subjects similar to what You was so [illegible] to ask my opinion upon. But I must ask Your pardon, as well for the bad writing of this as for some likely incoherencies in the other parts, which my press of business now & the want of Copyists just in this moment will leave in the whole. All the Field parties being gone & I engaged in finishing here so as to be able to follow in a few days.

Your Surveys to the North and between the Black and Caspian Sea I suppose are now considerably advanced, in the public papers such subjects are not often mentioned; in the french Journal l'Institut I have found the researches reported to Your Academy upon antiquities & languages of Asia which have interested me, because I had in my youth been sometime engaged in that line when preparing myself for an [illegible] diplomatist &c which I am not sorry to have exchanged for my present pursuits, as more satisfactory, because in it a man can do good by himself alone, while in the other branches it is too easy to others to turn one's well intentioned work into harmfull consequences

I hope the pleasure sometime to be informed again of the reception of my sending and of Your Continued Health & Happiness most [illegible] Yours
F. R. Hassler

Transcription

Washington City, 18th May, 1839

Tit: Admiral Krusenstern
at St. Petersburg, Russia

My dear Sir,

Your two so very friendly and agreeable letters of 13 June and 20th July a:p: [i.e., advance post?] gave me the greatest pleasure last September when they met me at one of the principal stations of the Coast Survey. I was not yet fully recovered from a sickness of more than a month, & very much engaged in determining azimuths, latitudes, terrestrial angles, and observing the solar eclipse so I was prevented in answer immediately, as my desire would have been.

On coming again here into Winter quarters I began a letter for you, & undertook to do some things towards solving the task which you gave me, upon the principles of mathematical instruction, but press of business distracted me again from it, & ultimately now I cannot find the letter itself, which I had begun two months ago. I returned again [to the task] but called of unexpectedly, its ultimate finishing has delayed untill [*sic*] now.

I join here, and shall show to Mr. Bodisco, your Ambassador here, the package which I intend for you, asking his advise, or action, upon the manner of sending it. Mr. Kremer, attache' to the Legation, promised me also to forward safely to you anything I should give to him.

It appears that I am unfortunate in the forwarding, as I occasion to my friends large expenses against my will, not withstanding all I try; a case like yours happened to me in England, where over 18 £ were charged, the package refused, & the books, reports, letters, &c., all burnt notwithstanding a Russian courier had been ordered to deliver it in London himself, instead of, as he did, throw it in the letter bag, on board the Liverpool packet, etc.

[end of first page]

This delay in time I intend to compensate to you by the collection which I have made during the time, of numbers of Documents, and Maps, which may probably be agreeable to you, so I shall make out of all one somewhat thicker letter package, one of printed Documents, and one a roll of Maps, among which two bad extracts from the Coast Survey called for by Congress, and executed "á la diable" by their engraver. I hope the whole will not cost you as much as before, though it may be worth for you at a distance, [like?] I consider as valuable similar things that come from a friend, notwithstanding I claim no special merit in this case. I join of course my last reports giving you account of my doings. I add to it, that since the last, I have delivered the whole of the over 100 sets of Standard Weights for the custom houses, each of 10. pieces between [1] lb and 50 lb. ; the yards are under final adjustment, the gallons ready for adjustment, the half bushels in casting + [*continued in margin note:*] every individual [kind?] to the number of about 150". The Coast Survey extends now over more than 3,000 square miles english in all the topographical details, the triangulation from 60 – 100 miles farther east & so forth. I shall take measures to have the part , comprehending the port of New York, put under finishing drawing, & engraving, but I am somewhat embarrassed to get good Copper plates; the english, which would be easiest obtained here, I distrust on account of the iron always contained in the english copper; the hungarian copper I consider the best in quality, but where are there printing plates made of it? That I do not know.

Since last fall I have also made considerable advances in the organisation and proper lodging of my works, in 3 houses joined, affording forty & odd rooms, all occupied alternately, or together, according to circumstances, by geometers, brass workers, mathematical instrument makers, casting estabblishment [*sic*], etc., etc. assistants. I have plenty by different weight, applications too thick, like blackberries [?]

[end of second page]

You call upon me for a statement of my views upon the principles of teaching mathematics is agreeable to me. I conceived immediately the plan upon which to treat it, but the delay from then to the execution has I believe not been advantageous to the best finish of the treatment of the subject, because I could not devote to it all consecutive time. Already in Swisserland [*sic*] , as a member of the Council of Education, I made a plan for our schools preparatory, & for elementary sciences, which worked very well & was much approved by men of sciences. When I became, in this country, Professor of Mathematics to the military academy, I made one for that institution, which was again approved, but not fully executed in the present establishment. Of these two I have no copies, but having only lately been called upon to give my ideas upon the form of disposing of the Smithsonian legacy, for an institution of instruction here, I can join here a copy of it. I have on various other [minor?] occasions made similar plans, but what success they had I could not know because of my moving off.

I may probably clear up my ideas in some respect, by adding here copies of my manuscript introduction to an analysis, which I was just writing, when I was again called in activity by the Government, and that of the natural philosophy begun to write for my Lectures in that Branch, as Professor at Union College in Schenectady, in 1810. In this latter you find entirely new principles upon the 1st elements; I think the bringing into an analytical formula the relations between gravity and cohesion etc. is lucid & solving difficulties in these elementary reasonings, which appear rather to have been turned around, then [met?].

[end of third page]

I have there tried to [precise?] more the principles of reasoning etc. or (ars philosophandi) and the ratio of all mecanics [*sic*], by the fully mathematical introduction of the time, as prototype of all motions. I should have liked to publish this introduction, but having not the time to fill out the whole work, of which a certain quantity is in M.S. [i.e., manuscript] I have not found a place proper to put it in the public.

In the paper I send to you here, upon your question, you will find that I have longer dwelt upon the elementary part than upon the higher branches, because I think this part the most essential to be organised in a more scientific form, than is habitual, and that by this neglect scholars are very much retarded, & many wrong ideas admitted; I wish therefore also that they shall be thought [i.e., taught] in their first principles by the same Professors, who being masters of the higher branches, know how to treat these elements by the [shortest?] and up to their higher branches; this I requested already in my school plan in Swisserland [*sic*], and with full good success, in more extensive institutions the Professors will be much relieved by the introduction of what I have called repetitors, so that they can keep the closer to the essential principles of the science as fact. In the higher Branches there is then no more need to proceed so strictly upon prescriptions, because the greater means acquired by the scholar ease the task of the Professor, and that to so much more advantage if he has been the man who has given them the first elements, can therefore quote himself always in one continued system, and knows upon what previous knowledge of his scholars he can ground his higher instruction. Besides then at these points of progress of studies the different minds & capacities have

[end of fourth page]

already taken a special more independent course, and deciding upon the future aim of their studies, are perhaps already distributed in special practical schools, organised to give the means to bring themselves forwards in their individual turn & propensity. These higher branches therefore in some measure order and discipline themselves. I have discovered by my introduction of the reasoning upon cause, time, and effect, expressed arithmetically, when I was teaching it to boys of 12 years, long before the printing, that these kind of reflections are very readily taken by the scholars and they worked upon it with peculiar satisfaction, & were gratifyed [*sic*] by finding [themselves?] above their examiners who had never come to so high a reflection for arithmetic, they solved by their means , & the reductions of the terms of the proportion to their smallest ultimate calculating numbers, questions which I knew at that time not a single Engineer officer in this country could solve.

Having encroached upon you so far as to give extracts of older writing of mine, I will yet add an improvement in one. In my analytical trigonometry, page 72 [i.e, Hassler's *Elements of Analytic Trigonometry, Plane and Spherical*], I have given a general series for the tangents, without division which is entirely new and unique in form compared with the other series of trigon. [i.e., trigonometric] functions; Cagnoli yet said "dans les tangents on nest pas encore arrive a eviter la division;" this induced me to the investigation, which proved successful. But in the page 72 as printed I have not yet selected the best form of presenting the binomial factors which enter of course in the series. I have since taken up the subject again, & present you here the bettered statement of whole thus; after the 7th line call the successive binomial coefficients n, n_1, n_2, n_3, etc, that is $n = n$; $n_1 = n(n-1)/1{\cdot}2$; $n_2 = n(n-1)(n-2)/2{\cdot}3$; $n_3 = n(n-1)(n-2)(n-3)/2{\cdot}3{\cdot}4$; etc. Then the series will be presented in the following form (the 1st term being denoted by A, the 2d by B, and so on for all subsequent terms, etc.)

[end of fifth page]

$$\text{tang } n\,a = \underset{\mathcal{A}}{n \text{ tang } a} + \underset{\mathcal{B}}{(n_1A-n_2)\text{tang}^3a} + \underset{\mathcal{C}}{(n_1B-n_3A+n_4)\text{tang}^5a}$$

$$+ \underset{\mathcal{D}}{(n_1C-n_3B+n_5A-n_6)\text{tang}^7a} + \underset{\mathcal{E}}{(n_1D-n_3C+n_5B-n_7A+n_8)\text{tang}^9a}$$

$$+ \underset{\mathcal{F}}{(n_1E-n_3D+n_5C-n_7B+n_9A-n_{10})\text{tang}^{11}a} + \text{etc.}$$

After the last phrase of the page is yet to be added:
"The general term may be easily deduced from the preceding; under the same denominations and calling the last term to be taken in the series by Z, and so retrograding, it will be as follows

term p
$$\text{tang } n\,a = (n_1Z - n_3Y + n_5X + \text{etc} + \text{etc} \pm n_{(2p-5)}B \text{ -/+ } n_{(2p-3)}A \pm n_{(2p-2)})\text{tang}^{(2p-1)}a$$

The upper signs being for p= an even number, the lower for p= an odd number.

As this has first appeared in an elementary work in which men of higher science had deigned to look (to often) it has remained unobserved hitherto.

You know well that the occasion for my work of the Survey of the Coast, was to get an accurate map You are certainly equally aware that the idea of making first an accurate full triangulation over the whole, like in Europe was inadmissible here, the insight into the principles of such work did not exist, but in very few persons. I had therefore already in '17 [i.e., 1817] brought the part of the work, which I had been able to make in a few months in such a state as to secure for geographical purposes only, with sufficient accuracy, in a small district; still seeing no maps, Congress could be misled in my absence, to destroy it, and their saying "I am sorry" did not mend it,

[end of sixth page]

as I said to our present President, when he told me "he would rather not have the work than so much trouble " because he had to approve the resolution of Congress against his will.

I have therefore at the 2d beginning of the work equally made haste to, what is called in this country, show them something for their money, and pushed the topographical works immediately after the measurement of the new base line+ *[continued in margin note:]* and the new additional triangulation of 1833, of which I believe I gave you account, [grounding?] in Latitude and Azimuth preliminarily upon the first years results, though made with somewhat imperfect means. After the [operations?] of last year the calculations were all renewed for the triangles, all observations for Lat. and Az. [i.e., Latitude and Azimuth] from different times and stations reduced anew to one; the results differed in Latitude 0,″3 and in Azimuth less than 2″ . This I consider as satisfactory enough to allow to print even Maps, which is now the Desideratum of all interested in the work, which I must try to satisfy, to avoid letting this part of the work fall in the hands of jobbers, by perhaps some side influence in Congress.

It is natural that I should like, when I come nearer here, to be able to join my work to an observatory well appropriated, this has in a great measure been spoiled by my own good willingness to assist before and even just when the C.S. [i.e., Coast Survey] began again, to assist Lieutenant Wilkes, now in the South Sea Expedition, to erect one of the transit instruments of the Coast Survey, which I lent to him, at the very spot where I had intended in 1816, to build one under a [mere?] wooden shelter, though upon stone pillars, as he had means to purchase the ground, house, &c., which I had not, nor could then propose on account of the positive prohibition of the C.S. Law that has rewarded me for this by the instigation against me and hence

[end of seventh page]

the disagreements, which you have probably seen in the Documents that I was ably to print, is unfortunate not a sufficiently [scarce?] example of — gratitude. I must still continue some years upon my same plan, by which I shall get several parts of accurate determined Lat: and Long: [i.e., Latitude and Longitude] Degrees that it will be possible also to use afterward scientifically.

The present Sec. of War prefers much the survey of the Northern Lakes, which I try to favor, that work could be joined to mine and we could get more extensive Data still, a Meridian from New York City to Montreal would be easy & fine &c.

I can not here state to you what I send in the two other packages in Data because it is the result of all that I could gather last winter that I think might interest you gradually put together; with this you will find several of my former writings upon subjects similar to what you was so trusting in me to ask my opinion upon. But I must ask your pardon, as well for the bad writing of this as for some likely incoherence in the other parts, which my press of business now & the want of [a] Copyist just in this moment will [leave us?] in the whole. All the field parties being gone & I engaged in finishing here so as to be able to follow in a few days.

Your Surveys to the North and between Black & Caspian Sea I suppose are now considerably advanced; in the public papers such subjects are not often mentioned, in the french Journal l'Institut I have found the researches reported to your Academy upon antiquities and Languages of Asia, which have interested me, because I had in my youth been sometime engaged in that line when preparing myself for an archivist diplomatist &c which I am not sorry to have exchanged for my present pursuits, as more satisfactory, because in it a man can do good by himself alone, while in the other branches it is too easy to others to turn one's well intentioned work into harmfull [*sic*] consequences. I hope the pleasure sometime to be informed again of the reception of my sending and of your Continued Health and Happiness.

Most [affectionately] yours
F:R: Hassler

7.6 Letter of May 1, 1841

Washington City 1st May 1841.

My dear Sir

Your very kind and agreable letter of the 25th Dec. 1840. reached me the 6th March, it appears to have proceeded at as quick a step thro the package which I handed for You to Your ambassy here.

I feel highly satisfied that my sending has been agreable to You, and that You concurr with me in the principles to be followed in the instruction, particularly in mathematical & phisical sciences. As member of the council of Education of the Canton of Argau, my native land in 1798. I first propo-sed the plan, dividing the School, I might say perpendicularly, according to the sciences, instead of before, horizontally accor-ding to progress, which latter then formed a mere subdivi-sion &c it was immediately approved, introduced with good effect, and aproved by other scientific men, it led to a fine cantonal establishment (by various intervening circumstances) which exists now.

I shall of course be attentif to collect what ever may come up in this country, in the branches of public economy and sciences, that might have interest for You. I have now but very little, as my last reports &c which I will try to make pass to You by the State Department here.

I take it as proof of Your friendly partiality to me, that You value what You are pleased to call my merits, which as to propose to me to ground upon them a proposition to H.M. the Emperor to honor me with a decoration. I feel the highest honor that could lie in the distinction, when obtained, already bestowed by Your proposition,

Your expressions in this respect have for me the fullest value, which an actual decoration could not augment. I am indeed an old republican by birth from many generations back; though without prejudice in this respect, however rather in the habit of considering the objects of this nature not fully so high as they are naturally to be considered in Monarchies.

The former habit of bestowing decorations only for military or Court services made them of course viewed differently in republics, therefore the Laws of republics, which are older than the newer habit of bestowing them upon scientific merits, are as yet averse to decorations, and such like.

Whilst I was in Bern in my youth 1786.–8. a special Law was yet passed prohibiting all orders, or decorations it was occasioned by the decision to prevent the Avoyer nero elected to receive the prussian black Eagle, which had been received by his predecessor. In this here newer republic, a positive Law prohibits these distinctions as well, as the nobility from any abuses in any way connected with the public affairs, Government, or administration; this furnishes the legal ground for my saving You the trouble of any application of that kind in my favor, the kind offer of which deserves no less my warmest thanks for Your friendly disposition.

+ by furnishing a legal ground

My works of the Survey of the Coast, and of the construction of standard Weights and measures, go on quietly, since I have won the battle, which You have seen in my printed Documents, the former, first so inimical, Secretary of the Treasury turned into the most friendly supporter of all, with the fullest confidence. Only some minor dis, appointed naval interest shews its horns sometimes, though

Some minor newspaper, of poor character, to no effect, and is therefore also not taken notice of.

My office is near the Capitol, in 3. adjoining buildings, presenting about 50. different appartments, the gradually increasing fame of it occasions, with the proximity, that Members of Congress come to visit the establishment, where the brillancy of our brass, and the many works they see going on, excites their approbation, and thereby secures the passage of my estimates for the C. S. in the appropriation bill; the $100,000 have been granted now 3 years without a dissenting Voice; the Weights and Measures are refered upon the custom house revenue, without needing an appropriation.

I expect shortly a dividing Engine from London, and a feeling lever comparateur from Berlin, they will complete my establishment for mathematical Instrument making, Comparison of standards, &c by which all our Instruments are kept in good order (+) and I am enabled to render service to all the 3 other Departments of the Government, State, Navy & War, who [illegible]ays apply to me for objects they need, and can [illegible]et good elsewhere, this is of course a means to assuage the ill will of many.

The Survey itself covered now, by two hundred maps or charts of regular Survey, upwards of eight thousand english square miles. We execute now the map of harbour & neighbourhood of New York for publication in 6. or 8. sheets upon the scale of 1/39,000. I am just in negotiation with an engraver from Europe.

The works occupy now about 100, persons under my direction seamens of 4, Vessels & many boats not counted; the administration part becomes more extensive than is agreable, and therefore robs me of much time that I should wish to employ otherwise, still I can not unload myself of any part of it upon any body else.

Several other particulars You will find in my last reports, of which I join several Copies to the small package which I wish to join here. I join also a map copied from an edition of Ptolomé's geography printed in Rome 1508. Although which is very rare, & I had bought in Paris 1796.

Accept my most sincere wishes, and completest Respect

Yours affectly

Admiral Krusenstern St Petersburg

F: R: Hassler

(+) and many [illegible]

Transcription

Washington City, 1st May 1841

My dear Sir

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Accept my most sincere wishes, and completest respect

Yours [affectionately]
F. R. Hassler

Admiral Krusenstern,
St. Petersburg

8. Bibliography on Ferdinand Rudolph Hassler

8.1 Hassler's Published Works

1825:

"Papers on Various Subjects Connected With the Survey of the Coast of the United States." *Transactions of the American Philosophical Society,* new series, 2, pt. 12 (1825): 232-420.

1826:

Corrections to the Papers on the Coast Survey Published in the Philosophical Transactions of Philadelphia. New York: F.R. Hassler; James Bloomfield, printer, 1826.

Elements of Analytic Trigonometry, Plane and Spherical. New York, F.R. Hassler, 1826. Also available online from Google Books: http://books.google.com/books?vid=OCLC27411575

Elements of Arithmetic, Theoretical and Practical : Adapted to the Use of Schools, and to Private Study. New York: James Bloomfield, 1826. Reprinted in new editions from 1828-1843.

1827:

[Reply to Roberdeau's "Observations on the Survey of the Sea Coast of the United States," 8th January 1827]. Miscellaneous Pamphlet Collection (Library of Congress). [Washington, D.C.?], 1827. Reprinted from National Journal of Washington. Also available online (with Roberdeau's *Observations*) from Library of Congress at: http://hdl.loc.gov/loc.gdc/scd0001.20030520003ob.1

1828:

Elements of the Geometry of Planes and Solids. Richmond, Va.: F.R. Hassler, 1828. Also available online from Google Books: http://books.google.com/books?vid=OCLC07695106

A Popular Exposition of the System of the Universe, With Plates and Tables. New York: G. & C. Carvill, 1828. Also available online from Google Books: http://books.google.com/books?vid=OCLC42258050

1830:

Logarithmic and Trigonometric Tables: to Seven Places of Decimals, in a Pocket Form. New York: C. & G. & H. Carvill, 1830. Revised editions issued in 1834, 1838, and 1844.

1832:

Comparison of Weights and Measures of Length and Capacity, Reported to the Senate of the United States by the Treasury Department in 1832. United States Congress (22nd, 1st session). House Document 299. Washington D.C.: Printed by D. Green, 1832. Also available online from NOAA: http://docs.lib.noaa.gov/rescue/cgs_rarebooks/Qc100u6h31832.pdf

1834:

Principal Documents Relating to the Survey of the Coast of the United States, Since 1816. New York: F.R. Hassler; printed by Van Norden, 1834. Also available online from Google Books: http://books.google.com/books?vid=OCLC24845075

Vollständiges Lehrbuch Der Theoretischen Und Angewendeten Arithmetik Für Den Öffentlichen Und Selbst-Unterricht. Aarau, Switzerland: Verlag von O.O. Christen, 1834.

1835:

Documents Relating to the Construction of Standards of Weights and Measures for the Customhouses: From March to November, 1835. New York: William Van Norden, Printer, 1835.

Second Volume of the Principal Documents Relating to the Survey of the Coast of the United States: From October, 1834, to November, 1835. New York: F.R. Hassler; William Van Norden, printer, 1835. Also available online from Google Books: http://books.google.com/books?vid=OCLC39544555

1836:

Documents Relating to the Construction of Uniform Standards of Weights and Measures for the United States, From 1832 to 1835. New York: Printed by J. Windt, 1836.

Third Volume of the Principal Documents Relating to the Survey of the Coast of the United States: and the Construction of Uniform Standards of Weights and Measures for the Custom Houses and States; From November, 1835 to November 1836. New York: Printed by John Windt, 1836. Also available online from Google Books: http://books.google.com/books?vid=OCLC39544557

1838:

Report From the Secretary of the Treasury, Transmitting a Report From the Superintendent of the Coast Survey, and of the Fabrication of Standard Weights and Measures, Showing the Progress of Those Works During the Present Year ... [December 6, 1838]. United States Congress (25th, 3rd session). Senate Document 4. Washington: Blair & Rives, printers, 1838.

Report From the Secretary of the Treasury, Transmitting the Report of F.R. Hassler, Superintendent of the Coast Survey, and of the Fabrication of Standard Weights and Measures, December 12, 1837. United States Congress (25th, 2nd session). Senate Document 79. Washington: Blair & Rives, printer, 1838.

Report From the Secretary of the Treasury: With a Report of F.R. Hassler, Superintendent of the Fabrication of Standard Weights and Measures ... July 4, 1838. United States Congress (25th, 2nd session). Senate Document 500. Washington: Blair & Rives, printers, 1838. Also printed as House Document 454.

1839:

Letter From the Secretary of the Treasury Communicating the Annual Report of the Superintendent of the Coast Survey, and of the Fabrication of Standard Weights and Measures, December 27, 1839. United States Congress (26th, 1st session). Senate Document 15. Washington, D.C.: Blair & Rives, printers, 1839.

1840:

Coast Survey: Letter From the Secretary of the Treasury Transmitting a Report of Professor F.R. Hassler, Superintendent of the Coast Survey, and the Fabrication of Standard Weights and Measures, Etc., December 15, 1840. United States. Congress (26th, 2nd session). House Document 14. Washington, D.C., 1840.

Standard Weights and Measures: Letter From the Secretary of the Treasury Transmitting a Report of F.R. Hassler, Superintendent of Weights and Measures, July 21, 1840. United States Congress (26th, 1st session). House Document 261. Washington D.C., 1840.

1841:

Standard Weights and Measures: Letter From the Secretary of the Treasury, Transmitting a Report of F.R. Hassler Respecting Ounce-Weights, July 13, 1841. United States Congress (27th, 1st session). House Document 33. Washington, D.C.: Gales & Seaton, printers, 1841.

1842:

Coast Survey: Letter From the Secretary of the Treasury, Transmitting a Report of F.R. Hassler, Showing the Progress Made Therein Up to the Present Time, January 3, 1842. United States Congress (27th, 2nd session). House Document 28. Washington, D.C., 1842.

Report From the Secretary of the Treasury Communicating a Report From the Superintendent of the Coast Survey, and of the Fabrication of Standard Weights and Measures, December 20, 1842. United States Congress (27th, 3rd session). Senate Document 11. Washington, D.C.: Thomas Allen, printer, 1842.

Standards of Liquid Capacity Measures: Letter From the Secretary of the Treasury Transmitting a Report Showing the Progress Made in the Fabrication of Standards of Liquid Capacity Measures, April 8, 1842. United States Congress (27th, 2nd session). House Document 176. Washington, D.C.: Gales & Seaton, printers, 1842.

1843:

Investigation Upon the Survey of the Coast of the United States, and the Construction of Standards of Weight and Measure by a Select Committee of Congress in 1842. Washington, D.C.: F.R. Hassler, 1843.

8.2 Archival Collections Relating to Hassler

American Philosophical Society, Manuscript Communications. American Philosophical Society, Philadelphia, Pa. Includes several letters from F.R. Hassler to various correspondents, dating from 1807 to 1828.

F. R. Hassler Correspondence, 1804-1847. New York Public Library. Collection consists of correspondence chiefly relating to Hassler's position as instructor at the United States Military Academy at West Point, N.Y., and to his service with the United States Coast Survey. Bulk of this collection was transferred from the Ford Autograph Collection.

F.R. Hassler Papers. U.S. Military Academy Library, Special Collections. Contents: Report, 13 May 1816, Philadelphia to Alexander J. Dallas secretary of the Treasury entitled: "Report of the measures to be taken at present relative to the survey of the coast". Includes the recommendation that "a few promising cadets" be trained in this type of operation along with the Corps of Engineers; contemporary copy of the report; letter, Philadelphia, 23 December 1840 regarding storage of equipment.

Hassler Family Papers Relating to F. R. Hassler. National Institute of Standards and Technology. Information Services Division. NIST Archives. On long-term loan from the family. Includes pamphlets by and about F.R. Hassler, and family correspondence and records. Also includes correspondence between Florian Cajori and Anita Newcomb McGee (Hassler's great-granddaughter) that was written between 1918 and 1930 as Cajori was working on his biography of Hassler. Also includes hand-written manuscript (incomplete) for Cajori's *Chequered Career of Ferdinand Rudolph Hassler*.

Papers of Admiral Krusenstern. Federal Archive Service of Russia, Russian State Archive of the Navy, Fond no. 14. Includes letters from F.R. Hassler to Admiral Krusenstern, 1830 to 1841. Also available as photocopies at the NIST Research Library. Reproductions included in this publication.

Papers of Anita Newcomb McGee. Library of Congress. Manuscript Division. Anita Newcomb McGee was a great-granddaughter of F. R. Hassler. Her papers contain letters from Hassler to his son Charles A. Hassler, and to Charles' wife, Anna Hassler. In the file “Correspondence of Charles A. Hassler,” bulk ca. 1835-1843.

Papers of Daniel Webster. Library of Congress. Manuscript Division. Contains one letter from F.R. Hassler to Daniel Webster, 1837.

Papers of James Madison. Library of Congress. Manuscript Division. Contains letters from F.R. Hassler to Madison, 1824-1835.

Papers of Robert Maskell Patterson (1787-1854). American Philosophical Society, Philadelphia, Pa. Includes letters to and from F. R. Hassler, and Hassler's list of books and instruments for the United States Coast Survey, 1817.

Papers of Simon Newcomb. Library of Congress, Manuscript Division. Simon Newcomb was married to Mary Caroline Hassler, granddaughter of F.R. Hassler. His papers include a file on "Genealogy" which includes a folder on F.R. Hassler. This includes the document "Sketch of the Life of the late F. R. Hassler, Originator and First Superintendent of the U.S. Coast Survey, Written by Mrs. A. J. Nourse Hassler." In Cajori's *The Chequered Career of Ferdinand Rudolph Hassler*, he states on p.28 that the unpublished memoir "Rosalie's Recollections" written by Hassler's daughter is in this collection. A partial search by the editors was unable to verify the location of this document.

Papers of the Northeast Boundary Commission, 1768-1822. Massachusetts Historical Society, Boston, Ma. Papers of the commission created under the 5th article of the Treaty of Ghent to establish the northeast boundary between Canada and the U.S. Included are F. R. Hassler's testimony upon the "geocentric latitude."

Papers of Thomas Jefferson. Library of Congress. Manuscript Division. Contains letters from F.R. Hassler to Thomas Jefferson, 1806-1826.

Scientists Collection. American Philosophical Society, Philadelphia, Pa. Includes several letters from F. R. Hassler to Samuel D. Ingham, dating from 1832 to 1842.

8.3 Other Works Related to Hassler

Adams, Oscar S. "Review of *The Chequered Career of Ferdinand Rudolph Hassler: First Superintendent of the United States Coast Survey*." *American Mathematical Monthly* 36 (1929): 283-285.

Anonymous. "The Coast Survey." *Harper's New Monthly Magazine* 58 (1879): 506-526.

———. *Remarks Upon the Survey of the Coast of the United States, [Washington, February 25, 1842]*. Washington, D.C., 1842. In the collection of the NOAA Central Library.

Bedini, Silvio A. "Ferdinand Rudolph Hassler." In *Thinkers and Tinkers: Early American Men of Science,* 358-367. New York: C. Scribner's, 1975.

Bowie, William. "The Work of the Coast and Geodetic Survey." *Cornell Civil Engineer* 34, no. 8 (May 1926): 193-198, 216-220.

Bray, Martha Coleman. *Joseph Nicollet and His Map*. Philadelphia, Pa.: American Philosophical Society, 1980.

Burchard, Edward L., and U.S. Coast and Geodetic Survey Library. *List and Catalogue of the Publications Issued by the U.S. Coast and Geodetic Survey, 1816-1902.* Reprint with Supplement, 1903-1908. Washington, D.C.: U.S. Government Printing Office, 1908.

Burroughs, Charles A. "Hassler's First Chart." *The Portolan* (Washington Map Society), no. 10 (Sept. 1, 1987): 9-16. Included in this publication.

———. "Remarks [at the Hassler Memorial Tablet Dedication]." *ACSM Bulletin* (American Congress on Surveying and Mapping), no. 216 (July/August 2005): 27-28. Included in this publication.

Bruce, Robert V. *The Launching of Modern American Science, 1846-1876*. New York: Knopf, 1987.

Cajori, Florian. "Swiss Geodesy and the United States Coast Survey." *The Scientific Monthly* 13 (1921): 117-129.

———. *The Chequered Career of Ferdinand Rudolph Hassler: First Superintendent of the United States Coast Survey*. Boston, Mass.: Christopher Publishing Company, 1929.

Cochrane, Rexmond C. "Ferdinand Rudolph Hassler: First Superintendent of the Coast Survey and of Weights and Measures." Appendix A in *Measures for Progress: a History of the National Bureau of Standards*. NBS Miscellaneous Publication 275. Washington, D.C.: National Bureau of Standards, 1966.

Davis, Charles Henry. "Reply to an Article in the February Number of Hunt's Merchant's Magazine on the Coast Survey of the United States." *Hunt's Merchants' Magazine and Commercial Review,* April 1849, 3-15.

Dracup, Joseph F. "History of Geodetic Surveying: Part 1, The Early Years, 1807-1843." ACSM Bulletin (American Congress on Surveying and Mapping), no. 154 (March/April 1995):15-19. Included in this publication.

Dupree, A. Hunter. *Science in the Federal Government: A History of Policies and Activities to 1940*. Cambridge, Mass.: Belknap Press of Harvard University Press, 1957.

"Ferdinand Rudolf Hassler (1770-1843): Swiss Pioneer for US Surveying, Mapping and Standards: Exhibition: METAS, Wabern, July 8 - August 10, 2007." Dieter Schneider, Project Leader. Swiss Federal Office of Metrology, Swiss Federal Office of Topography, and the Swiss Federal Archive. http://users.quick-line.ch/schneider-we/Hassler/Hassler-e.htm

Fischer, Louis A. *History of the Standard Weights and Measures of the United States.* Bureau of Standards Miscellaneous Publication 64. Washington, D.C.: U.S. Government Printing Office, 1925.

Frazier, Arthur H. "The Monument for Ferdinand Rudolph Hassler at Laurel Hill Cemetery, Philadelphia." *ACSM Bulletin* (American Congress on Surveying and Mapping), no. 62 (August 1978): 15-17.

Genovese, Ilse. "In Pursuit of Exactitude." *ACSM Bulletin* (American Congress on Surveying and Mapping), no. 216 (July/August 2005): 24-26. Included in this publication.

Glatthard, Thomas, and Alfred Bollinger. "Swiss Precision for US Mapping: Ferdinand Rudolph Hassler, First Chief of US Coast and Geodetic Survey and US Bureau of Standards." Paper presented at FIG (International Federation of Surveyors) International Congress, XXII, Washington, D.C., April 16-26, 2002. Available online from the International Federation of Surveyors: http://www.fig.net/pub/fig_2002/HS2/HS2_glatthard_bollinger.pdf

Greenhouse, Lisa A., ed. *Ferdinand Rudolph Hassler, 1770-1843: Measuring the Young Republic.* U.S. Superintendent of Documents no. C 13.2:H 27. Gaithersburg, Md.: U.S. Dept. of Commerce, National Institute of Standards and Technology, 1998.

———. "Weights and Measures Exhibit [NIST Virtual Museum]." NIST. http://museum.nist.gov/exhibits/ex1/index.html

Henry, Thomas R. "Historic Geodetic Survey Vacating Capitol Hill Home." *The Evening Star* (Washington, D.C.), March 30, 1929, 16.

Homans, J. Smith. "Coast Survey of the United States." In *Cyclopedia Of Commerce and Commercial Navigation*, 321-330. New York: Harper & Bros., 1858.

Linklater, Andro. *Measuring America : How an Untamed Wilderness Shaped the United States and Fulfilled the Promise of Democracy* . New York: Walker & Co., 2002.

"NOAA Celebrates 200 years of Science, Service and Stewardship." NOAA 200th Anniversary Celebration Web Team. NOAA. http://celebrating200years.noaa.gov/welcome.html

Parr, Albert C. "A Tale About the First Weights and Measures Intercomparison in the United States in 1832." *Journal of Research of the National Institute of Standards and Technology* 111, no. 1 (January/February 2006): 31-40. Included in this publication. Also available online from NIST: http://nvl.nist.gov/pub/nistpubs/jres/111/1/V111.N01.A03.pdf

Perry, John. *The Story of Standards*. New York, Funk & Wagnalls, 1955.

Pratt, Elizur H. *A Historical Sketch of the Town of Cape Vincent: Read at the Centennial Celebration of the Township, July 4, 1876.* Cape Vincent, N.Y.: W.W. Ames, printer, 1876. Also available online from Cornell University: http://resolver.library.cornell.edu/moap/any7454.

Rickenbacher, Martin. "Die Basismessungen Im Grossen Moos Zwischen Walperswil Und Sugiez." *Cartographica Helvetica* 34 (July 2006): 3-15. Also available online from the Swiss Federal Office of Topography: http://www.swisstopo.ch/pub/down/about/publi/CH-2006-34.pdf

Roberdeau, Isaac. *Observations on the Survey of the Sea Coast of the United States : [Paper Read Before the Columbian Institute on the 9th of December, 1826]* Miscellaneous Pamphlet Collection (Library of Congress). [Washington?], 1827. Reprinted from the National Journal of Washington. Also available online (with Hassler's reply) from Library of Congress: http://hdl.loc.gov/loc.gdc/scd0001.20030520003ob.1

Smith, Edward S. C., H. Arnold Karo, and Laurence M. Gould. *Ferdinand Rudolph Hassler: Professor of Natural Philosophy and Mathematics, 1810-11*. Union Worthies 13. Schenectady: Union College, 1958.

Smith, R. A. "Ferdinand Rudolph Hassler," in *Smith's Illustrated Guide To and Through Laurel Hill Cemetery,* 73-74. Philadelphia: Willis P. Hazard, 1852.

Stanley, Albert A. "Hassler's Legacy." *NOAA Magazine* 6, no. 1 (1976): 52-57. Included in this publication.

Strasser, G. "Ferdinand Rudolf Hassler." *Vermessung, Photogrammetrie, Kulturtechnik*. July 1987, 276-278.

Stratton, Samuel Wesley. "The Bureau of Standards and its Relation to the United States Coast and Geodetic Survey." In *Centennial Celebration of the United States Coast and Geodetic Survey, April 5 and 6, 1916, Washington, D.C*, edited by U.S. Coast and Geodetic Survey, 25-40. Washington, D.C.: U.S. Government Printing Office, 1916. Included in this publication.

"Survey of the Coast." *The North American Review* 42, no. 90 (January 1836): 75-94.

Theberge, Albert E. "The Coast Survey, 1807-1867 Volume I of the History of the Commissioned Corps of the National Oceanic and Atmospheric Administration." NOAA. http://www.lib.noaa.gov/edocs/CONTENTS.htm

U.S. Coast and Geodetic Survey, ed. *Centennial Celebration of the U.S. Coast and Geodetic Survey, April 5th and 6th, 1916, Washington, D.C*. Washington, D.C.: U.S. Government Printing Office, 1916.

"United States' Coast Survey." *The North American Review* 54, no. 115 (April 1842): 446-454.

Weber, Gustavus A. *The Coast and Geodetic Survey: Its History, Activities and Organization* Service. Monographs of the United States Government 16. Baltimore: Johns Hopkins Press, 1923.

Wolf, Rudolf. "Ferdinand Rudolph Hassler von Aarau." In *Biographien Zur Kulturgeschichte Der Schweiz*, v.2: 320-354. Zurich: Orell, Fussli & Co., 1859.

———. *Geschichte Der Vermessungen in Der Schweiz, Als Historische Einleitung Zu Den Arbeiten Der Schweiz. Geodätischen Commission*. Zürich, S. Höhr, 1879.

Wraight, A. Joseph, and Elliott B. Roberts. *The Coast and Geodetic Survey 1807-1957: 150 Years of History*. Washington, D.C.: U.S. Government Printing Office, 1957.

Zölly, H. *Geschichte Der Geodätischen Grundlagen Für Karten Und Vermessungen in Der Schweiz*. Switzerland: Stiftung Dr. Joachim de Giacomi; Schweizerische Naturforschende Gesellschaft; Eigendnössische Landestopographie, 1948.

Zschokke, Emil. *Ingenieur F. R. Hassler Von Aarau*. Aarau, Switzerland: Verlag Sauerländer, 1877.

———. Translation from the German of the Memoirs of Ferdinand Rudolph Hassler by Emil Zschokke, Pub. in Aarau, Switzerland, 1887, With Supplementary Documents. Edited and translated by Rosalie L. Hassler Norris. Nice, France: V.E. Gauthier and Co., 1882.